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The Labor Shortage

There has been much complaint on the part of industries in various sections of the country over the labor shortage. Many people are using it as an argument for the enactment of more liberal immigration laws. It may not be out of place to point out that a labor shortage of this kind is not an unmixed evil. Economists seem to agree that there is not now enough goods being produced in this country to allow all of the people to have all of those things which are regarded as necessary in the best interests of the community as a whole, even if these products were evenly distributed. It is extremely desirable, therefore, that the production be increased.

There are many labor saving machines and devices of merit which have not been used as widely as they should be, because of the plentiful supply of labor in this country. There are many other labor-saving machines and devices which will be devised under the pinch of necessity, if the labor shortage continues. These devices not only will increase the production per capita, but in many cases will relieve the laborers of hard, tedious, distasteful work. An example of this may be seen in the wonderful development of the practices in the steel mills during the last generation, or in the road-building processes where the best types of machinery are used. There are many places in railroad shops, enginehouses and car repair yards where the production can be increased without adding to the force, if advantage is taken of labor-saving and material-handling devices of proven merit. Sometimes it takes a near catastrophe to force the adoption of improved practices and better machinery—in other words, to get out of the rut. The labor shortage may therefore prove to be "an angel in disguise."

Elimination of Waste Competition

There is a tremendous amount of waste in industry, as was most clearly pointed out in the investigation carried out by the Federated American Engineering Societies at the suggestion of Herbert Hoover. Probably no technical research in industry has attracted so much attention as has this study. Mr. Hoover made this significant statement in the foreword to the report: "We have probably the highest ingenuity and efficiency in the operation of our industries of any nation. Yet our industrial machine is far from perfect. The wastes of unemployment during depressions; from speculation and over-production in booms; from labor turnover; from labor conflicts; from intermittent failure of transportation of supplies of fuel and power; from excessive seasonal operation; from lack of standardization; from loss in our processes and materials—all combine to represent a huge deduction from the goods and services that we might all enjoy if we could do a better job of it."

Most of the factors mentioned by Mr. Hoover are, of course, beyond the control of any one railway officer or group of officers. Fortunately, however, many agencies are at work to develop ways and means of controlling these larger factors. On the other hand, there are great possibilities for eliminating waste on the part of the individuals engaged in any one single industry, or even in a small department or section of that industry. The difficulty is that too many officers and men get into the rut of routine work or are content to go along and not give much constructive thought to making better use of their time or facilities. Sometimes this extends even to the actual waste or destruction of material. The *Railway Mechanical Engineer* believes that great good can be accomplished if a clearing house could be set up in the mechanical department where experiences could be exchanged as to actual accomplishments in eliminating waste, either by making better use of the time of the workers or facilities, or by doing away with practices which were responsible for the loss and waste of material or energy.

We have therefore decided to offer two prizes, the first one of $50 and the second one of $35, for the best two articles which are received on or before November 15, telling of actual instances of eliminating such wastes. The judges will award the prizes on the basis of the constructive value of the suggestions. The details should be clearly given and accompanied by illustrations wherever possible. Articles not awarded a prize, but which are used for publication, will be paid for at space rates. We have been delighted with the way in which our friends have entered the recent competitions which we have held; we have purposely made this one of a more general nature, in order that men from all sections and parts of the mechanical department may find an opportunity to enter it.

Adopt the Standard Cars

The most important question to be decided by the letter ballot of the members of the Mechanical Division this year is whether or not the box car designs proposed by the Car Construction Committee are to become the standards of the American Railway Association. The proposal that the railroads adopt and build box cars of standard design has been before the railroads for years. The question was brought to an issue and work actually started by the former American Railway Association, largely through the influence of the late E. P. Ripley, president of the Atchison, Topeka & Santa Fe, who was dissatisfied with the apparent lack of interest in the project shown by the Master Car Builders' Association. The work of the former A. R. A. committee was not completed, because of the war, and since the close of the war has come into the hands of the successor to the Master Car Builders' Association, the Mechanical Division, which is now an official organization acting for the American Railway Association.

With the report of the Car Construction Committee presented at the June meeting of the Mechanical Division, the development of standard box cars has been brought as near to a conclusion as it probably ever can be brought by any committee. The present Car Construction Committee is as wide-

ly representative as a workable committee can be made and the designs produced by a committee of different personnel, while they would undoubtedly differ from those now before the Mechanical Division, would probably come no nearer to completely satisfying all of the members. The discussion of the committee's report at the June meeting brought out the fact that the standards proposed leave competition unrestricted, within the limits of the standard details and limiting dimensions already adopted by the association, in the selection of proprietary devices now in general use. There has been no question but that the general designs will produce good cars—just how good relatively, is an open question that can be settled only after a period of service experience. Whatever reasons may be given by the individual members, therefore, should they not accept the committee's designs by letter ballot, will mean that it is practically impossible for the railroads voluntarily to establish standard box car designs. Any officer who believes that such designs ought to be adopted, cannot afford to let the present opportunity escape.

Specialization in Railroad Shops

There has been developed a high degree of specialization in the processes of many manufacturing industries. In some cases, especially where highly developed special machine tools are used, this has gone so far that little scope seems to be left for the exercise of the intelligence of the operator. However unsatisfactory this may be because of the social problems thus created, the fact remains that it has tremendously increased the volume of output in relation to the amount of labor required, with corresponding decreases in manufacturing costs.

On first consideration, there seems to be a very meager opportunity for the application of similar methods in the railroad shop. Here conditions differ from those found in industry, in that similar repair operations are seldom exact duplicates. Each locomotive, each car, and to some extent each similar detail presents special problems, the ultimate solution of which must be left to the intelligence of the workman.

But though the limits of specialization may be much more restricted than in manufacturing industries, there are increasing evidences of a marked tendency toward successful specialization in the locomotive and car repair shop. For some time there has been a growing disposition to replace the pit gangs, once so generally employed in the locomotive shop, with specialist gangs each responsible for a more or less restricted group of operations.

During the shop crafts' strike last year it was found possible to make satisfactory equipment repairs with organizations in which the entire force was made up of hastily trained specialists each of whom knew but one job. And further evidence that such an organization is not without merit is contained in an article, elsewhere in this issue, describing the methods employed by the Morgan Engineering Company in its contract locomotive repair shop. Without experienced locomotive men, either among the supervisors or in the ranks, this company successfully undertook the repairing of locomotives on a commercial basis with an organization in which a comparatively small percentage of the employees can even be rated as mechanics. Specialization has been developed to a high degree and in a large measure is responsible for the successful operation of the plant.

In calling attention to the success with which specialized methods have been employed in the repair shop, it is not the purpose to advocate that railroad shops be operated with complete forces of semi-skilled men whose competence is limited to one or two operations. We believe, however, that no fully qualified mechanic is capable of performing every operation in his craft with equal facility and that output increases with the steadiness of application to and the frequency of repetition of a given job by the employee. Furthermore, the highest degree of specialization practicable in the railroad shop leaves ample scope for the exercise of the highest degree of intelligence leading to the development of expert knowledge of the job and its relation to the serviceability of the equipment. In the locomotive shop it has been found that the specialist to a large extent becomes his own supervisor and a real assistant to the general foreman. All of this makes for well-balanced, smooth-running organization and has been found to spell "output" in railroad shops where specialization has become the practice.

The Engine Terminal Competition

Engine terminal management in many respects is the most difficult job in the mechanical department. The back shop, for instance, controls the balance between the classes of repairs under way at any time, the engine terminal takes whatever work comes in. Direct responsibility for keeping down engine failures lies with the engine terminal and not with the back shop; and yet the terminal has to turn the power to meet the requirements of the transportation department rather than its own need for time in which to make repairs. Most terminals have peaks of activity at certain hours during the day, and few of them are ever adequately equipped with time and labor-saving facilities, either for floor or machine work. Both of these conditions make it especially difficult to avoid the wasteful employment of labor.

It is because the management problems thus created are not readily solved that in last month's issue of the *Railway Mechanical Engineer* we announced a competition in which prizes of $50 and $35 will be awarded to the authors of the two papers containing the most constructive suggestions (1) for expediting the turning and dispatching of locomotives, (2) for simplifying inspection and repairs and (3) for keeping engine failures at a minimum when heavy business does not permit much time in the hands of the mechanical department. For instance, consideration has been given in some terminals to the development of a comprehensive schedule of running repair cycles by which the attention to be given each locomotive as it comes into the terminal can very largely be anticipated. And many simple shop-made devices have been developed with which the shortage of facilities has in a measure been overcome. What measures have you found successful in your terminal in meeting any one or all three of the conditions enumerated above? We are not interested in the operation of the ideal terminal layout, but in the methods of management by which you are getting the most out of the plant as it stands. There is still time to tell us, if you have not already done so, but the papers must be received at our office of publication, 30 Church Street, New York, not later than October 15. Any papers, other than the prize winners, which we publish will be paid for at space rates.

Training of Foremen

Some of our friends have criticised us for pounding so incessantly on the necessity of better training for foremen and others holding supervisory positions. Let it therefore be clearly understood that we have the greatest appreciation for the loyalty of the foremen and for the splendid records which they have made, especially during recent years. It is not our intention to criticise them, but rather to pave the way for increasing their opportunities and giving them a larger place in the mechanical department organization. Those supervisory officers who come in intimate contact with the rank and file are *key men*. That they have not always functioned as effectively as they might is in a large degree due to the fact that the managements have failed to recognize this and the foremen

have been handicapped by not being fully informed as to difficulties under which the road was operating and as to the policies of the management; they have not even been educated as to the simple economics of railroad operation so far as it concerned the relations of their own department to the organization as a whole.

It is vitally important that the foreman should act as an interpreter to the men of the policies of the management and the difficulties confronting it, and to the management of the feelings and attitude of the men. To do this properly requires a very considerable amount of educational training along various lines. Real foremanship is not a job but an art. A foreman should be given every opportunity of learning those things which will help him to be a better and more successful leader. The task of having to lead and direct large numbers of men in industry is so comparatively new that it has not been very well understood until within recent years. There is ample material now available, however, so that there is no excuse for the foremen and officers not being fully informed in these respects.

It has been found that the development of foremen's clubs and foremen's get-together meetings can be approached with excellent results during the fall months and before the severe winter weather comes on. Programs should be developed now and meetings arranged for the coming months. Plans are being made along these lines on several roads. The movement can only be extended as generally as it should be, however, by having the co-operation of all of the men in supervisory positions. An expression on the part of the foremen at a shop, for instance, for the need of an educational program of this kind, would undoubtedly be greatly appreciated by many of the managements. It may not be out of place to suggest the rereading of the discussions by Messrs. Bentley and Demarest on shop management problems at the June meeting of the Mechanical Division, reported in the July number of the *Railway Mechanical Engineer*.

Drill and Reamer Grinders

A good workman is known by the condition of his tools, and machinists who attempt to perform drilling, reaming or milling operations with dull tools are either ignorant or careless and certainly cannot qualify as efficient workmen. Viewed in the aggregate, the amount of drilling, reaming and milling work in railroad shops is almost staggering and the loss to the railroads is proportionately great when the tools used for this work are maintained in any but the best possible condition for efficient cutting. Greater power is required to operate dull tools; the time required for a given operation is longer, and the resultant work produced is inferior in quality. In view of these facts, it is apparent that too much attention cannot be given to the condition of cutting tools.

It is impossible for the proper attention to be given to cutting tools without suitable equipment in the toolroom in the way of drill, reamer and cutter grinders. Probably few railroad shops worthy of the name are without twist drill grinders, since the practice of re-conditioning twist drills by hand grinding is long since out-of-date. Great care should be taken, however, to see that these grinders are properly adjused to turn out satisfactory work. There are only a few essential requirements in grinding a twist drill to make it cut efficiently. These requirements are absolutely essential, however, and the modern twist drill grinding machine is so designed as to take care of these requirements automatically, producing a drill which—as relates to the shape of the two cutting lips—is practically perfect. Present twist drill grinding equipment in railroad shops should be carefully examined to see if it is turning out work of this character and if not, it will unquestionably pay to install the more modern type of twist drill grinder.

The maximum effective service or life of reamers and milling cutters cannot be obtained unless they are sharpened on one of the plain or universal grinding machines which has been built for that purpose in accordance with correct principles of design. Plain cutter and reamer grinders are available for simple operations such as grinding straight, spiral, or angular milling cutters; straight or taper reamers; shell or end mills, and similar tools. Universal grinders are used to sharpen straight, taper or rose reamers; bevel, spiral, form, or end-milling cutters; taps, countersinks or counterbores. Universal grinders can be used for grinding straight or taper arbors and also for small internal grinding jobs. The universal tool grinder is essential wherever there is a variety of cutting tools to be kept in serviceable condition and its cost of installation will be repaid many times in the increased production or longer life of cutting tools, decreased power consumption and cost of operation; also a noticeably better morale among the workmen who have not the incentive to get results when handicapped by dull tools. In general, it will pay railroad men to benefit by the advice of the manufacturers as to type of grinding wheel and method of set-up and it is particularly important to secure all the attachments needed for their efficient use.

What Our Readers Think

Additional Comment on C. M. & St. P. Method of Center Sill Analysis

Butler, Pa.

To the Editor:

In the August issue, L. K. Sillcox takes exception to the writer's assumptions relative to center sill analysis which appeared in the November, 1922, issue.

The writer wishes to call attention to the fact that these assumptions were not put forward dogmatically but were merely suggested for the consideration of your readers. The assumptions, however, are not unwarranted, as Mr. Sillcox states; in fact they are more logical than those submitted by him in the original article which called forth the discussion. Flat car center sills were not discussed; the sills in question are those of a gondola car with trussed sides and ends. These members are very rigid in comparison to the rigidity of the center sills and so the assumption that the center sills of this type of car may be considered as a beam fixed at its points of support, is quite reasonable. Moreover the writer's assumptions show greater stress at the bolsters and less at the center of the car while those of Mr. Sillcox show less stress at the bolsters and more at the center. If the latter were nearer the truth than the former, we should find the center sills damaged at the center instead of at the bolsters; the evidence found in any repair yard confirms the former.

The A. R. A. requirements for center sill area have been changed from 20, to 25, to 30, and to 28 sq. in. during a short period of time. What the area should be is still an open question, for even at the recent A. R. A. convention this subject received considerable discussion without any definite conclusion. Requirements for prescribed fibre stresses due to given loads, are meaningless unless the assumptions for computing the stresses are also laid down.

Mr. Sillcox states that the clattering observed in a string of cars upon which a car has impinged, indicates the initial blow to be transmitted from one car to the other down the track. This statement is correct but it should be noted that the clattering subsides as the end of the string is reached, showing that each car has taken part in dissipating the energy of the initial impact. The important point, however, is that the clattering between the first and second cars of the string, does not take place until after the first car has re-

ceived its maximum blow; the clattering between the second and third cars does not take place until the second car has received its maximum blow; and so on until the energy has been dissipated. This statement may be verified by a study of the diagram on page 160 of "Draft Gear Tests of the U. S. Railroad Administration." The diagram shows that at the time of maximum compression, the struck car has moved only 1.10 in. from the point of initial contact while the impinging car has moved 6.49 in. from this point. The clattering between the struck car and its neighbor would just about begin with a movement of 1.10 in., especially if the slack was not bunched. Even though some clattering were present at this instant, the force between these cars could not be great because when the unresisted slack is deducted from the 1.10 in. of total movement there is left very little resisted movement. The writer did not assume the entire end shock to be dissipated within the car structure but used the accepted load of 250,000 lb.

There surely was no intent to offend anyone by making the statement that the field of research in car design has hardly been touched. The choice of construction in present-day designing is largely a matter of precedent which in many cases antedates the use of steel cars. Even Mr. Sillcox, in his August communication, states that "in publishing the articles describing the C. M. & St. P. designs there was not the slightest intention of producing something new which heretofore has not been done. . . ." The amount of loss and damage charged to defective equipment on Class I railroads for January and February was $865,361. The April issue of the National Geographic Magazine contains some statistics which divides the life of a freight car per year as follows: About four weeks running loaded, eleven weeks running empty, six weeks in switching service, five weeks in repair yards and the balance in idleness due to various factors. The number of cars in the United States is given as 2,348,000. It is true that parts of the car such as truck side frames and bolsters, draft gears, wheels and brake shoes have been carefully investigated. However, the comparatively short life of the car, the damage charged to its defects and the time spent in the repair yard compared with the time running loaded, are direct indications that there is room for more intensive, constructive research. The profit of such research to the railroads becomes obvious when the number of cars and their invested value are considered.

WENDEL J. MEYER.

A Stitch in Time

KANSAS CITY, MO.

TO THE EDITOR:

On page 236 of the April, 1923, *Railway Mechanical Engineer*, L. K. Sillcox, general superintendent of motive power of the Chicago, Milwaukee & St. Paul says in part: "What the mechanical department expects from the locomotive terminal is to derive from it a medium by which locomotives may be cared for and maintained properly, promptly and cheaply and from which locomotives may be consistently delivered to the transportation department with the result that the serviceable hours per locomotive per day and the serviceable days per locomotive per year may be increased to a maximum." There is no doubt that many railroad men hold the same view as Mr. Sillcox. In fact, it is easy to understand what it means to transportation to increase the number of hours or even minutes that a locomotive can haul its tonnage without interruption. The astonishing figures given by G. S. Goodwin in the 1915 proceedings of the American Railway Master Mechanics' Association showed that engines actually were moving tonnage only 4 hr. and 16 min. out of each 24 hr. of the day.

The following instances of typical roundhouse experience illustrate by inference what could be done with a little forethought and co-operation on the part of all concerned to improve conditions and increase locomotive revenue hours.

Referring to the roundhouse records at a certain large terminal on July 8, 1915, an engineer reported the following work: Change water in boiler; right injector will not work. The transportation department requested that this locomotive be returned to service as soon as possible, and the injector was therefore repaired and the boiler filled with fresh water and fired. With the steam at 60 lb. the injector was tried but did not work right. The tank was examined and found with very low water. It was decided to move the locomotive to a water crane, fill the tank and raise the steam pressure to 100 lb. the crew in the meantime being called. Finally, with 100 lb. of steam and the tank full of water the injector still would not work properly. As the injector had been examined, the trouble was plainly with the feed water apparatus which was a syphon with a strainer on the bottom of the suction pipe inside the tank. The strainer was found clogged with foreign matter, which could not be removed without draining the tank of 7,000 gal. of treated water.

The second instance selected at random occurred on December 4, 1918. The right tank hose nut on a locomotive dropped off the feed pipe end and the crew tried to close the tank valve which was of the socket type. The valve stem could not be turned so they attempted to couple up the hose while the water was running and failing in this applied a plug. After all their efforts and getting wet to the skin the crew measured the water in the tank and found that there was not enough water to run the locomotive to the next water station! Their feelings can be readily imagined! Another engine was ordered to pick up the train and defective engine and proceed to the terminal. As this was on a Saturday with a Sunday layover there were not enough men on duty to make repairs and the locomotive laid over until Monday causing a shortage of one locomotive on Monday morning.

Delays and troubles similar to those mentioned are largely avoidable. They can be prevented by the development of competent, careful inspectors and repair men at the terminals and by the co-operation of all in reporting and correcting conditions which may cause delays.

W. F. POTTS.

New Books

CAR LIGHTING BY ELECTRICITY. *By Charles W. T. Stuart,* 352 *pages, 6 in. by 9 in.,* 250 *illustrations, bound in cloth. Published by Simmons-Boardman Publishing Company,* 30 *Church Street, New York.*

This book has been written to meet the need of the practical man as well as the engineer and the student. For those engaged with the construction, operation, inspection and maintenance of car lighting equipment it provides a practical discussion of the subject couched in language intelligible to the average non-technical reader. The text gives a brief history of railway car lighting; a general description of the three electric systems used—straight-storage; head-end, and the axle-generator systems—and a detailed description of the construction, installation, and operation of the various axle-generator systems, with the regulating apparatus, transmission, storage batteries, lighting circuits and fixtures. The testing and inspection of car lighting equipment is also discussed and many of the special tools developed for use in repair work are described. The present stage of development of direct-drive equipment for the axle-generator system of car lighting is described briefly, and there is also appended the specifications covering the car lighting standards and Recommended Practices of the American Railway Association. The term "profusely illustrated" may very properly be applied to this work; the many photographs, drawings, and charts, directly "tied-in" with the text, give a very comprehensive presentation of the subject. The book should prove immensely valuable to men interested in car lighting.

There Are No Working Pits in the Morgan Locomotive Erecting Shop

Ordnance Plant Makes Locomotive Repairs

Morgan Engineering Company Adapts Buildings to Railroad Contract Work with But Few Changes

FOLLOWING the war, the Morgan Engineering Company, manufacturers of overhead cranes and other heavy mill equipment, Alliance, Ohio, found itself with a large plant, unequipped except with cranes, that had been built for the manufacture of heavy ordnance. The demand for outside capacity for heavy locomotive repairs, which developed after the drastic curtailment of mechanical department forces on the railroads in 1921, led to consideration of the utilization of this plant as a contract locomotive repair shop. Accordingly, after a satisfactory form of contract had been worked out, which required the development of a base, sufficiently detailed to cover all usually performed operations while still retaining a degree of flexibility which would take care of all work the need for which becomes evident only after a locomotive has been stripped, an organization was developed and operations started.

The first engines were repaired during the latter part of 1921. Owing to unsettled labor conditions, however, operations did not actively get under way until the fall of 1922.

A floor plan of the building in which the locomotive repair work is conducted, is shown in the drawing. The building consists of what may be termed a header bay, 840 ft. long by 90 ft. wide, from one side of which opens a series of parallel bays extending out at an angle of about 34 deg. from the header bay. As these bays all terminate in a single end wall, they vary in length from about 115 ft., in the case of the short bay opening into the header bay nearest its southern end, to about 530 ft. for the east bay opening from the north end of header bay. The building is of steel frame construction with brick curtain walls at the lower portion of the sides of the building, above which there is an unbroken expanse of steel sash. Additional light is admitted through glazed openings in the roof.

This building is located in an enclosure adjoining the south end of the main plant yard, in which its manufacturing operations are conducted. The two enclosures are separated by a street, but communication is maintained between them by continuous industrial tracks and by the plant roadways, over which material is transported by motor truck.

The Erecting Shop

The most interesting feature of the locomotive repair shop is the method of handling erecting shop work. The erecting shop occupies the long bay from which open the parallel bays, and has floor space for 70 locomotives in addition to those on the stripping and wheeling tracks. This building originally was not equipped with pits and had but two tracks running through it, one along either side. With practically no changes in the floor construction it has been adapted to effective use as a locomotive erecting shop by the portable structural steel stools on which the locomotives are supported. These are of sufficient height to permit work to be done under the engines after they have been stripped and placed on their "spots" without the necessity of floor depressions and with better lighting under the locomotives than normally found where they are set over pits. The only change in this shop has been the construction of pits along the track on the east side, which is used as a wheeling and finishing track. As will be seen from the illustrations, the locomotives are placed on their spots in "echelon" so that the tubes may be removed from the front end of one locomotive without interference from the locomotive next in front of it.

At the north end of the erecting bay is what is known as the testing block. Here the first spot in each of the four rows between the stripping and wheeling tracks is devoted to the making of hydrostatic tests.

The erecting bay is served by three Morgan cranes, all operating on the same ways. The capacity of the first toward

the north end of the shop is 75 tons, of the next, 40 tons, and of that toward the south end of the shop, 25 tons. Slings are used at both ends of the locomotives when lifting with the cranes. In moving a locomotive about the shop, the sling from the 75-ton crane is placed around the barrel of the boiler just ahead of the firebox, while the 40-ton crane lifts the front end.

The stripping track accommodates six locomotives. Here the engines are completely stripped, the parts removed to the lye vat, cleaned and delivered to the machine shop by the stripping gang. After stripping, the locomotive is unwheeled and moved to the "spot" assigned to it, where the boiler, frame and cylinder work is done. When ready to be assembled, the boiler and frames are moved by crane to the wheeling track. This track has a capacity for ten engines, on seven stations. The first two pits, starting from the north end of the building, are devoted to wheeling. After the binders have been put up, each engine is moved from one of these two pits to the next station. Here one pit is devoted to the application of piping, superheater units, lagging and jackets. One pit is also assigned to the next station, where the cab is put on and the motion work, crossheads, pistons and main rods applied. The locomotive is then moved to one of the next two pits, which constitute the valve setting station. Here rollers are put under the engine and the valves set. At the next station the grate, grate rigging, ash pans and brake rigging are put up. Then, on the next pit, the cylinders are closed, piping completed and the steam piping and superheater units subjected to hydrostatic test. The locomotive is then moved to the final station inside the building where the tank is coupled up and the engine pulled out of the shop, ready to be fired up.

Locomotives are broken in on the tracks of the Morgan Engineering Company, some of which are long enough to permit of thorough testing. When accepted by the inspectors representing the railroad company, the rods are taken down and the engine prepared for shipment.

The progress of the engine from the wheeling pit to the outside of the shop usually requires from five to six days. Should any unexpected delay hold up the progress of an engine on this track, it is moved out of the way by the cranes so that those behind it are not thrown off schedule.

Boiler Shop and Fittings Department

The drawing shows the general arrangement of the departments which occupy the parallel bays opening into the erecting shop. Like the erecting shop, each of these bays is well equipped with overhead cranes, and a comparatively small amount of special equipment has been installed.

Starting at the south end of the erecting shop, the first of these bays is occupied by the flanging department. This bay is about 50 ft. wide and is served by one 40-ton overhead crane. It is equipped with an annealing furnace, three open fires and one hand and one pneumatic flanging clamp.

The next bay, which is about 90 ft. wide, is occupied by the flue shop, the arrangement of which is shown in one of the photographs. The equipment includes three welding sets, each consisting of a Draper hammer and a Ferguson furnace. One of these is used on superheater flues and the other two on tubes. These facilities are arranged along the south wall of the bay. Two Ryerson flue rattlers of the wet type have been placed on the shop floor at the east side of the bay near the erecting shop, one of which can be loaded and unloaded by crane, while the other requires manual loadings. The flues are tested under 100 lb. air pressure, submerged in water.

Looking Down the Flue Shop

Owing to the practice of the Morgan Engineering Company of taking in as many locomotives as the available erecting floor space will permit, irrespective of the number on which work is actually being performed, a large number of sets of tubes are stored in the flue shop. Instead of progressing from one operation to another with no intermediate handling, the practice is to complete each operation on each set of tubes, after which the entire set is moved by crane to the station of the next operation.

The outer end of the third bay is occupied by the boiler shop for laying out firebox sheets. The remainder of this bay is devoted to the repair of detail fittings. On the west side are located a battery of six small engine lathes, a small shaper and one Lassiter-Milholland staybolt machine. The latter machine gives an output of 350 staybolts, turned and threaded, in 12 hours. On the east side are located two planers which are used on shoes and wedges, as well as one small combination open-side planer and shaper. This bay is approximately 50 ft. wide and is served by one 10- and one 25-ton crane, the heavier crane being located toward the erecting shop end.

The next bay to the east, which is approximately 90 ft. wide, is devoted to heavy boiler work. Here the work on all boilers requiring new fireboxes or back ends is completed

before the boilers are returned to the erecting shop. This department is provided with one vertical and one horizontal punch, a vertical shear and a radial drill for drilling tube sheets. The shop is not equipped with a heavy bending roll and all firebox or boiler shell sheets requiring bending are sent outside. On the east side of this bay is located a testing block for superheater units. Here all units are tested and inspected as they are removed from the locomotive, to locate those requiring renewal. After the units have passed this test, they are stored in sets in the next bay, so piled that all header joints are accessible. The joints are ground with a portable machine as they lie in the pile.

This bay is equipped with one 25-ton crane toward the south end, and a 40-ton crane toward the erecting shop end. The floor space at the inner end of the bay is available for spotting a number of locomotives. Engines to be placed in this space, after being unwheeled, are moved by the erecting shop cranes to the wheeling track on the east side of the erecting bay, and placed on two car trucks provided with heavy timber bolsters. The engine, thus mounted, is then hauled into the lateral bay, over the track shown in the drawing, by using a cable attached to the 40-ton crane. This brings it under the cranes of the lateral bay, by means of which it can be moved to its assigned space on the floor.

The outside bay is about 50 ft. wide. It is devoted to engine truck repairs, cabs, and superheater unit storage. Space is also provided in this bay, just off the erecting shop, for lagging storage and reclamation. No provision is made for remolding broken lagging. Broken material is pulverized and tempered for bulk use in plastic form.

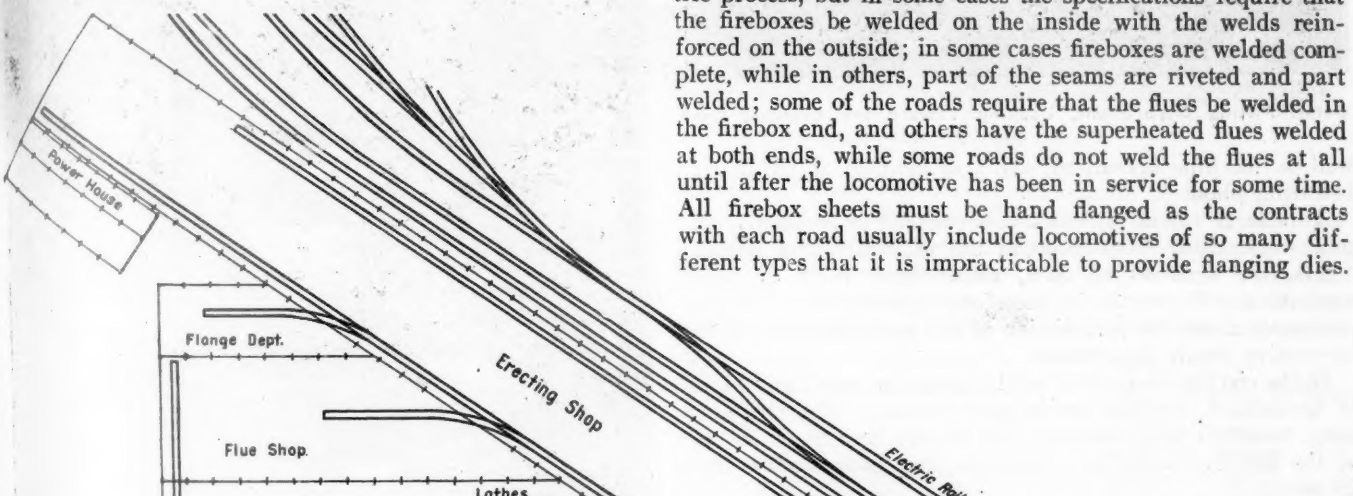
This bay, which is equipped with two 10-ton cranes, was formerly used as a tender repair shop. Tender work, however, has now been transferred to one of the buildings in the manufacturing plant, which was formerly occupied by the iron foundry.

Work Can Not Be Standardized

The work of the shop is necessarily affected by the fact that the shop is usually working on locomotives for from seven to ten different railroads, each of which has its own standards, not only as to the type and size of details, but as to shop methods. This is particularly true with respect

Pits Have Been Provided Under the Wheeling Track

to the boiler work. All boiler welding is done by the electric process, but in some cases the specifications require that the fireboxes be welded on the inside with the welds reinforced on the outside; in some cases fireboxes are welded complete, while in others, part of the seams are riveted and part welded; some of the roads require that the flues be welded in the firebox end, and others have the superheated flues welded at both ends, while some roads do not weld the flues at all until after the locomotive has been in service for some time. All firebox sheets must be hand flanged as the contracts with each road usually include locomotives of so many different types that it is impracticable to provide flanging dies.

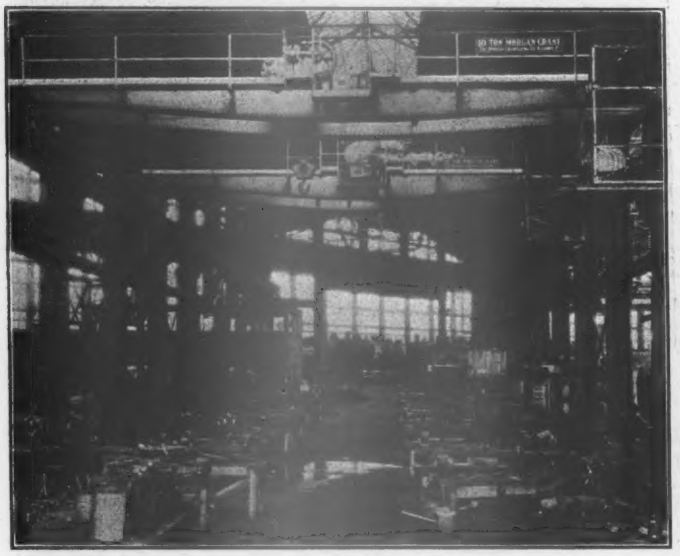


Layout of Morgan Engineering Company Locomotive Repair Shop

Each railroad has its own inspection organization, and both the Morgan Engineering Company and the railroad inspectors are provided with complete sets of drawings of the locomotives passing through the shop. Much of the material, particularly brass and iron castings and all special fittings, are furnished by the railroad. Each railroad is provided with its own storehouse in charge of its own storekeeper. These stores are housed in small buildings of frame construction, adjoining the south wall of the parallel bays.

Shop Organization

All heavy machine work, such as that required on running gear parts, motion work, cylinders and other castings, is handled in the machine department of the manufacturing plant, where the parts are routed through the shop and sugsigned to machines along with the material going through the plant on production jobs. All blacksmith operations, as well as machine operations, are also handled at the manufacturing plant.



Detail Fitting Department, Looking Toward the Erecting Shop

To a large extent the employees engaged in locomotive repair work, aside from those in the manufacturing departments, are semi-skilled men, rather than fully qualified mechanics. The work is, therefore, specialized in all departments under the jurisdiction of the superintendent of the locomotive repair department.

In the erecting shop, most of the gangs are small and highly specialized, working under gang leaders. The stripping gang, to which brief reference has already been made, is one of the largest, including a foreman, two gang leaders and 25 men.

A special gang is organized to handle work such as boring cylinders, valve chambers, putting on new cylinders and frames, etc. Motion work, shoes and wedges, spring rigging, brake rigging, lagging, jacketing, pipe-fitting, rods, wheeling and binders, headlight and lighting equipment, truck repairs, tank repairs, and running test work is each in charge of a separate gang. The detail fitting department, in which about 75 men are employed, is in charge of a foreman, who has two assistant foremen, one in charge of the machines and the other of the fitting. All work pertaining to wheeling the locomotives and the motion work is in charge of one foreman. Another foreman supervises the spring rigging and shoe and wedge work. A third is in charge of all other work on the wheeling track. All welding and cutting work is handled by one gang, which is in charge of a foreman. There is one general foreman in charge of the machinist and floor work and another in charge of the boiler department. Practically none of the supervisors, or of the employees have had previous railroad shop experience. The organization has been built up from the Morgan Engineering Company's own personnel.

Eighty per cent of the men in the boiler department are also semi-skilled specialists. In this department, one gang does nothing but remove sheets which are to be renewed. The sheets are then taken to the laying out department, where the new ones are laid out, punched, sheared and made ready for the fitters. The fitting gang then assembles the sheets ready for the welders or riveters. The welding is performed first, after which the rémaining joints are riveted and caulked. The staybolts are then applied, followed by the crown bolts, each operation being performed by a separate gang. The boilers requiring new fireboxes or back ends are removed to the boiler shop. After the above operations have been completed, each boiler is sent to the test block, where it is washed out and the tubes applied. It then receives a hydrostatic test and is placed back on its assigned "spot" on the erecting floor where a miscellaneous gang cleans up any work developed as a result of the test. The testing block gang takes care of all boiler work which develops during the running test after the locomotive has left the shop.

During the month of June, there was an average of about 1,000 men actually working on locomotive repairs, approximately 250 of which were boiler makers and helpers, 300 were employed in the machine and forge departments, and 450 on the erecting floor, air brake repairs and tank shop.

Structural Steel "Stools" on Which Locomotives are Supported

During the month of June the output was 36 locomotives, none of which, of course, required less than Class 3 repairs—many of them running very heavy. Of the 40 engines completed during the month of July, two boilers required complete new back ends; seven required new fireboxes; 20 required new back tube sheets, door sheets and inside side sheets. The remaining 11 required either new back flue sheets or new side sheets and patches.

Locomotive Service Tests on the N. C. & St. L.

Engine with Nicholson Thermic Syphons Runs Against One of Similar Design Not So Equipped

During the early part of the present year the Nashville, Chattanooga & St. Louis made a series of road tests of two Mikado type locomotives of similar dimensions, one of which was equipped with Nicholson thermic syphons, to determine a comparison of the performance of thermic syphon-equipped locomotives with others not so equipped. The results of these tests are of interest in that they confirm the results which have been obtained in similar tests on other railroads, in which the locomotives equipped with the syphons have invariably shown a reduction in fuel consumption per one thousand gross ton miles.

A comparison of the principal dimensions of the two locomotives is shown in one of the tables. It will be seen that, while they are generally similar, there are a number of slight differences. The cylinders of engine No. 651 are of slightly larger diameter than those of engine No. 660, the syphon-equipped locomotive, while the driving wheels of the latter locomotives are three inches larger in diameter than those of the non-syphon locomotive. These differences in dimensions account for the difference in the tractive effort, which is 58,300 lb. for locomotive No. 651 and 54,800 lb. for locomotive No. 660.

The only other difference worthy of comment is in the distribution of the heating surface. Engine No. 660, which is one of 12 new Mikado type locomotives equipped with thermic syphons delivered to the Nashville, Chattanooga & St. Louis in November, 1922, has five more superheater units than the earlier class to which engine No. 651 belongs, and 26 less 2¼-in. tubes. The result of these differences is that the new locomotive has 139 sq. ft. less tube and flue heating surface and 110 sq. ft. more superheating surface. Both locomotives have the same size firebox, the only difference in firebox heating surface being that resulting from the application of two syphons, which are installed with two of the four arch tubes used in the older locomotives. Including arch tubes and syphons, engine 651 has a total of 317 sq. ft. of firebox heating surface, while engine 660 has a total of 371 sq. ft. of firebox heating surface.

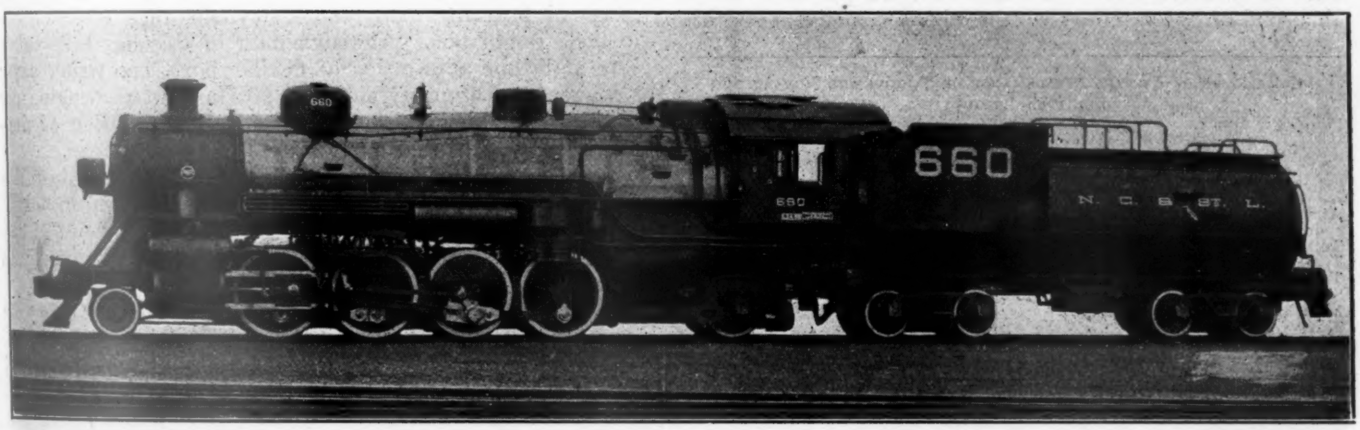
Owing to the fact that a smaller tender is used with the new locomotives, there is a difference in the total weight of engine and tender of approximately 16,000 lb. in favor of the new locomotive.

The syphon-equipped locomotive had been in service about 60 days prior to the beginning of the tests. Locomotive 651 was turned out of the back shop about 40 days prior to the tests and was in good condition. Throughout all of the test runs the same crews operated both locomotives, which are equipped with stokers, and were fired by a traveling fireman.

The tests were made on the Chattanooga division between Nashville, Tenn., and Cravens, a district 149 miles long. Southbound, there are two ruling grades, one about five miles long, of 0.92 per cent and the other about seven miles long, of 0.93 per cent. Northbound, there is one ruling grade of 0.94 per cent, six miles long. In addition to these grades, there are pusher grades, where a helper is used in both directions, over the Cumberland mountains.

A dynamometer car was used for recording the speed, drawbar pull and the location of throttle and reverse lever positions. Water calculations were made by measuring the water before and after filling the tank and coal calculations were made by measurement of the amount of coal in the tank before the beginning and after the completion of each run. The tests were made with through tonnage freight trains, with a tonnage rating southbound of 1,800 tons and northbound of 1,600 tons. The tonnage was calculated by using the stenciled weight of empty cars and the scale weights of loads, taken from the bills.

Test data were compiled for three trips southbound and four trips northbound. The average results of test trips in both directions are shown in one of the tables. Southbound, the average conditions were favorable for the non-syphon



N. C. & St. L. Locomotive No. 660 Equipped with Nicholson Thermic Syphons

Dimensions of Locomotives Used in N. C. & St. L. Thermic Syphon Tests

	Without syphons	With syphons
Locomotive No.	651	660
Type	Mikado	Mikado
Tractive force, lb.	58,300	54,800
Weight on drivers, lb.	220,000	220,000
Weight of engine and tender in work. order, lb.	481,340	465,000
Cylinders, diameter and stroke, in.	26 5/16 by 30	26 by 30
Diameter driving wheels, in.	60	63
Heating surface, sq. ft., 5½-in. flues	1,090	1,231
2½-in. tubes	2,407	2,127
Firebox	290	290
Arch tubes	27	12.5
Syphons	....	68.5
Total, evaporating	3.814	3,729
Superheater	882	992
Firebox, length and width, in.	114⅛ by 84¼	114¼ by 84¼
Grate area, sq. ft.	66.7	66.7
Tender capacity, water, gal.	10,187	9,739
Coal, tons	16	16

locomotive. The trip with this locomotive included an average of 1 hr. 15 min. less dead time than those with the syphon-equipped locomotive and the atmospheric temperature averaged more than 12 deg. higher. Both the average trainload handled by the syphon-equipped locomotive and the average speed while running was higher than for the other locomotive, and the fuel consumption per thousand gross ton miles was 9.91 per cent less. Comparing the performance on a drawbar horsepower-hour basis, the syphon locomotive showed a fuel consumption of 4.02 per cent less than the other locomotive, while the equivalent evaporation per pound of coal was 14.26 per cent greater.

On the northbound trip the conditions as to delays favored the syphon-equipped locomotive; the average dead time of 2 hr. 35 min. per trip with this locomotive was 52 min. less than the average for the other locomotive. The difference in average tonnage on the northbound trip was slight, although the number of cars averaged one less per train for the syphon-equipped locomotive than for the non-syphon-equipped locomotive.

On these test trips the syphon-equipped locomotive showed an average fuel consumption 11.52 per cent less per thousand gross ton miles than the other locomotive. On these trips the fuel rate per drawbar hp.-hr. of the syphon-equipped locomotive was 8.57 per cent less than that of the non-syphon-equipped locomotive, while the equivalent evaporation per pound of coal was only 7.01 per cent greater.

COMPARISON OF AVERAGE PERFORMANCE OF SYPHON AND NON-SYPHON EQUIPPED LOCOMOTIVES

	Southbound			Northbound		
	Loco. 651, without syphons	Loco 660, with syphons	Difference, per cent	Loco. 651, without syphons	Loco. 660, with syphons	Difference, per cent
Atmospheric temperature, deg. F.	62.6	49.0	....	58.0	41.2	....
Total time on road, hr., min.	10–34	11–26	....	10–04	8–43	....
Total running time, hr., min.	6–52	6–33	....	6–37	6–03	....
Total dead time, hr., min.	3–42	4–53	....	3–27	2–35	....
Speed, m. p. h.	21.81	22.81	+4.59	22.64	24.76	+9.36
Number of stops	12	13	....	12	12	....
Tons per train	1,763	1,806	+2.38	1,569	1,555	—.89
Cars per train	42	42	....	40	39	....
Gross ton miles, thousands	262.6	270.0	+2.82	235.3	231.8	—1.49
Total ft. lb., millions	12,838	12,351	—3.79	10,206	9,887	—3.13
Total coal fired, lb.	39,927	34,155	—7.51	31,148	27,392	—12.06
Total water, lb.	222,639	235,580	+5.81	195,403	183,453	—6.12
Coal per hr., per sq. ft. grate area	81.2	78.4	—3.46	70.7	68.1	—3.68
Equivalent evaporation, lb. water per lb. coal	6.03	6.89	+14.26	6.27	6.71	+7.01
Coal per 1,000 gross ton-miles, lb.	140.2	126.3	—9.91	133.7	118.3	—11.52
Water per 1,000 gross ton-miles, lb.	847.9	872.3	+2.88	829.8	792.2	—4.53
Coal per drawbar hp.-hr., lb.	5.72	5.49	—4.02	6.07	5.55	—8.57
Water per drawbar hp.-hr., lb.	34.52	37.83	—9.59	37.82	36.86	—2.54

In neither case was there any difficulty in maintaining boiler pressure. The temperature of the steam entering the cylinders, however, averaged 19 deg. higher in engine 660 than in engine 651, the temperature being 607 deg. and 588 deg., respectively.

Combining the runs made by each locomotive in both directions, it will be seen by referring to the table that the syphon equipped locomotive handled a slightly larger average train load over the division in an average of almost one-half hour less time, with 10.7 per cent less fuel per one thousand gross ton miles.

AVERAGE PERFORMANCE OF COMBINED NORTHBOUND AND SOUTHBOUND RUNS

	Loco. 651, without syphon	Loco. 660, with syphon	Difference
Average running time, hr.	6.742	6.3	—6.55
Average speed, m.p.h	22.225	23.785	+7.0
Tons per train	1,666.0	1,680.5	+0.9
Gross ton-miles, thousands	248.95	250.9	+0.8
Lb. coal per 1,000 gross ton-miles	136.95	122.3	—10.7
Lb. water per 1,000 gross ton-miles	838.85	832.25	—0.8
Average drawbar hp.	867.0	889.5	+2.59
Lb. coal per drawbar hp.-hr.	5.87	5.48	—6.6

Combustion Chamber Boilers*

OWING to the importance of the subject your committee sent inquiries to those members who have had the longest experience with the combustion chamber. The inquiries included: General efficiency of chamber. Defects that were first to develop and remedies applied. Number of broken bolts per engine per month, and kind of bolt. Defects developing in the various parts of the chamber, and the life of the parts. Size or length of chamber. The diameter, length and number of tubes and flues. Whether equipped with brick arch or not. Hand fired or stoker? If chambers were not a success what was done to make them so?

There is a remarkable difference in the efficiency and life of the chamber on the various railroads using them. Some railroads are equipping old power with the chamber, others are removing the chamber and applying the straight box, also ordering new equipment with the straight box. There also is a great difference in the length of chambers. Those mentioned in our correspondence varied in length from 24 in. to 56 in.

The majority agree on the fact that the chamber is the cause of breaking many more staybolts than were broken in the straight box. Although most of this has been taken care of by the application of flexible bolts, one writer says: "We renewed as many as 35 to 40 staybolts per engine per month, and although we applied a full installation of flexible bolts, we still find many broken bolts."

Another member wrote: "Since applying a full installation of flexible bolts we have little trouble with broken bolts."

Other defects that develop are cracks at rivet holes of circular seam and wings of throat sheet, the former sometimes extending into the base of flange.

Pits, grooves and cracks, occur along both top and bottom base of flue sheet flange and from base of flange to flue holes. These cracks often extend in both a vertical and horizontal direction, sometimes extending through bridges.

Cracks at arch tube holes. Cracks at front row of staybolt holes in bottom of chamber extending from 18 to 30 in. in length. Cracks at base of throat sheet wings.

Excessive pitting and grooving of wrapper sheet back of flue sheet seam and over front portion of crown.

Staybolt leakage in bottom of chamber.

To remedy the trouble with circular seams and wings flanges and wings of new throat sheets were extended and autogenously welded.

Defective flue sheets were renewed in some cases at the end of two years' service; in other cases at the end of three or four years. One member wrote: "Back flue sheets in our Pacific type engines with 72-in. shell and 36-in. combustion chamber last seven years. With straight standard firebox flue sheet gave four years' service." Two other members wrote: "Our combustion chambers are seven years old, but we have not renewed any flue sheets." The tendency to crack at arch tube holes was taken care of by one member by additional bracing when renewing throat sheet. The cracks at base of throat sheet wings were remedied by increasing the radius of the flange in new applications. The leakage of bolts in bottom of chamber was stopped by applying a layer of fire brick over the affected part.

A majority of the writers agreed that the tubes and flues were more efficient in the chamber type boiler, and their mileage was increased from 50 to 100 per cent.

There is considerable difference in the number and length of tubes and flues in the combustion chamber boilers. The smallest has 158, 2-in. and 22, 5½-in., length 16 ft. 2 in., the largest has 275, 2¼-in. and 50, 5½-in., length 21 ft. 0 in.

The report was signed by H. J. Raps (I. C.) chairman and Emil Ziegenbein (M. C.).

*Abstract of a report submitted at the Annual Convention of the Master Boiler Makers' Association, Detroit, Mich., May, 1923.

Power Plant Equipped to Burn Fuel Oil

Flexible Boiler Operation and Labor Saving Secured by Burning Oil in Enginehouse Power Plant

THE power plant at the Boston (Southampton street) enginehouse of the New York, New Haven & Hartford supplies steam and compressed air not only for the enginehouse needs but for the South Bay passenger car yards. Steam is generated at 200 lb. pressure by two 300-hp. boilers, the steam pressure in the yard being reduced to 80 lb. The air pressure carried is 110 lb. Up to December 1, 1922, these two boilers were fired with bituminous coal, arrangements being made on that day to change over from coal burning to fuel oil-burning equipment, the apparatus for which had been installed.

When operated coal burning, the two boilers consumed 30 to 35 tons of coal in 24 hours and in view of the increased demand for steam, it was practically impossible to keep up pressure especially when one boiler was shut down for cleaning the fire which occurred every 8 hours. It was, therefore, a question of increasing the number of boilers at Southampton street, installing some equipment which would give the boilers a greater overload capacity, or rendering the boiler operation more uniform by eliminating the necessity for cleaning fires. The latter alternative was chosen and oil-burning equipment installed, not only eliminating the difficulty formerly found in cleaning fires, but greatly reducing the labor costs of handling coal and ashes. The boilers, as equipped to burn fuel oil, were operated continuously for a period of several months and at no time was there demands for steam in excess of the boiler capacity.

Material Reduction in Labor Costs

The saving in labor may be appreciated from the fact that in winter eight men were ordinarily required for unloading coal, with three firemen and two coal passers. The services of nine of the thirteen laborers, coal passers and firemen are no longer required, there now being employed with the oil-burning equipment only three firemen and one laborer. This force is the same for both summer and winter.

Description of Storage Tank

An important part of any oil-burning equipment is the storage tank for holding oil which in this case has some features of special interest. The Southampton street enginehouse is located largely on made land and it was necessary, therefore, to secure a solid foundation for the storage tank and make it of some material which would resist the action of ground water at high tide. The problem was solved by excavating and driving piles below low-water level, six concrete supporting ribs being cast on these piles and the tank itself, of reinforced concrete, resting on these ribs. The outside dimensions of the tank are 30 ft. by 50 ft. by 5 ft. deep, the top being flush with the surface of the ground as shown in Fig. 1. The tank is divided lengthwise into two main sections, *M* and *N* (indicated by the dotted line), each of these sections being separated into a cold and hot well by an additional cross partition. The hot wells are comparatively small, located in the nearer ends of the two sections and provided with heating coils to keep the oil at a temperature for ready circulation. Holes near the bottoms of the cross partitions enable oil to flow from the cold to the hot wells.

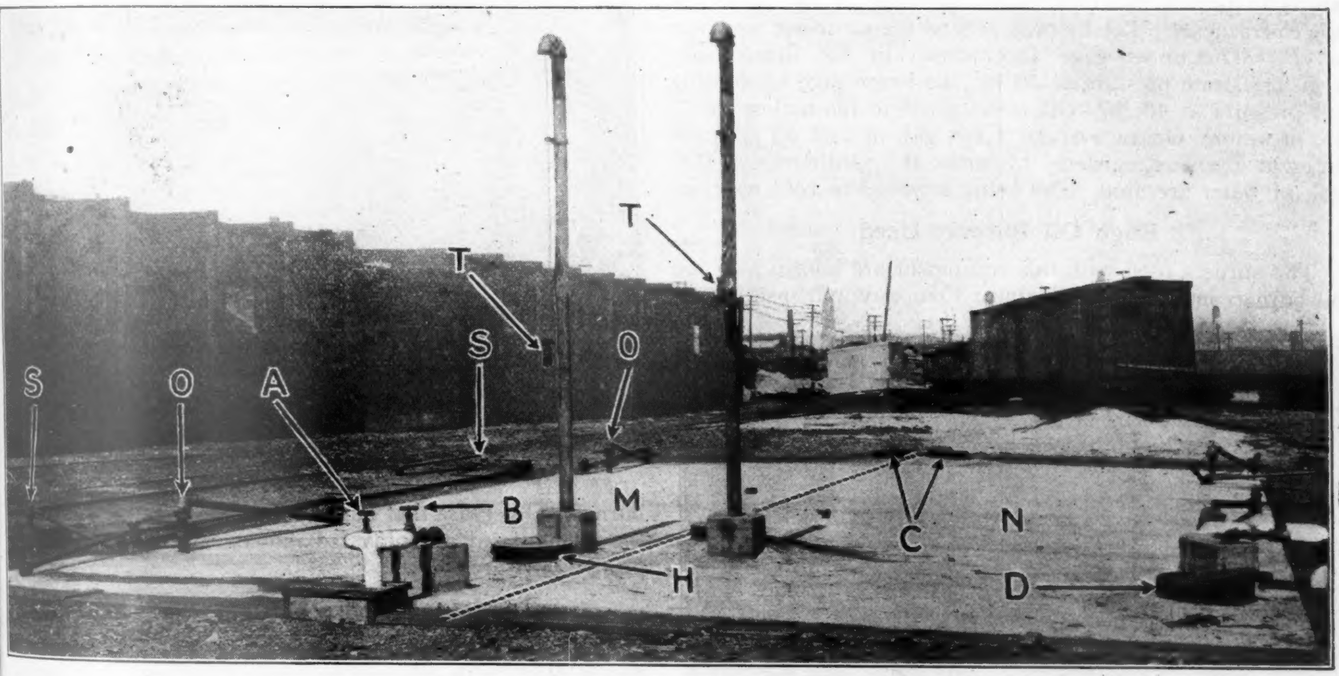


Fig. 1—General View of Oil Storage Tank with Telltales Indicating the Two Sections to Be About One-Half Full of Oil

Sections *M* and *N* are practically duplicates so a description of only one (section *M*) will be given. Referring to Fig. 1, section *M* is filled with oil from tank cars through pipes *OO*, the oil in the car being kept at approximately 100 deg. F. so that it will flow readily by means of steam from pipes *SS*. It will be noted that a similar set of oil and steam pipes is provided at the right in Fig. 1 for section *N*. Manholes *CC* give admittance to the cold wells and *H* to the hot well. Manhole *D* leads to a small dry tank in the

nearer end of section *N* used for purposes of inspection. Telltales *TT* indicate the level of oil in the two tanks respectively. The hot well in each case is provided with six coils of 1¼-in. pipe 6 ft. long, laid 4 in. above the bottom of the tank to keep the oil in this section at the proper temperature so that it will readily flow to the pump in the power house. All of these pipe joints are welded and tested before application. Valve *A* controls the steam supply to the hot tank and consequently its temperature. Valve *B* admits steam to a blanket line to be used in case of fire. A by-pass is provided from one tank into the other for possible use in emergency.

Vacuum Heating and Pumping System

From the tank, oil is piped to the Worthington vacuum heating and pumping system, illustrated in Fig. 2. This consists of two duplex pumps, one heater *H*, two oil strainers *SS*, two thermometers *TT* and a Bowser oil meter *M*. The temperature is raised by means of this heater to 180 deg. F., the steam pressure on the heater being 30 lb. The exhaust from the pumps is fed to the heating system.

The particular feature of this pump is its arrangement in duplicate throughout with by-passes at each important point so as to provide for continuous operation of the boilers in all emergencies. The by-pass around the oil meter is shown at *B*. The upper gage (not shown in the illustration) registers steam pressure at 30 lb., the lower gage *G* showing oil pressure at 40 lb. Oil is delivered to the boilers at 35 lb. pressure. On an average, 1,144 gal. of fuel oil are used in eight hours as registered by meter *M*. Ordinarily 15,000 gal. of water are used, more being required in cold weather.

Engo Oil Burners Used

The burners used with this equipment are known as Engo oil burners made by the Engineer Company and installed as

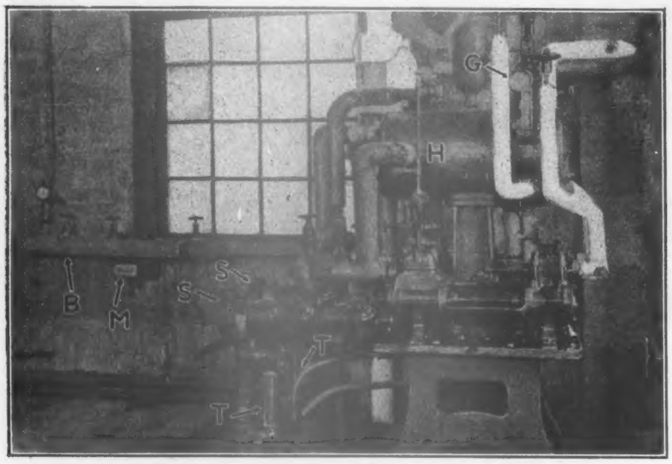


Fig. 2—Worthington Vacuum Heating and Pumping System

shown in Fig. 3. The burners themselves are in operation, being hidden by the guard plates *GG* which serve to protect firemen against the heat from the boiler. The draft gage for the boiler is shown at *D* and the oil pressure gage at *O*, *S* being a steam gage and *T* a thermometer for registering the temperature of the oil. Referring to the oil-burning unit at the left, which is a duplicate of the one at the right, *A* is the valve for controlling steam to the burner and *B* the valve controlling the oil supply. Valve *C* controls the amount of mixture fed to the furnace and therefore the intensity of the flame. Adjusting handle *E* controls the amount of air admitted to the boilers by opening or closing a fan-shaped ventilator. In the illustration this ventilator is well open giving a view of the intense flame in the furnace through the openings.

Certain precautions must be observed in operating oil-burning equipment. In the first place, in the hot well of the storage tank oil must not be overheated or it will vaporize with resultant danger of explosion. As a further precaution, all open lights must be kept away from the storage tank. In the boiler room it is not advisable to depend upon hot brick for igniting a burner which has gone out in view of the possibility of explosion. The operation of the boilers must be watched a little closer when burning oil than coal for this reason. It is important to see that the burners are not forced to such an extent that flames enter the tubes, evaporating the water so fast that adequate protection is not afforded the tubes which as a result burn out.

One man should be on the watch continuously with oil-burning furnaces especially when each furnace has only one

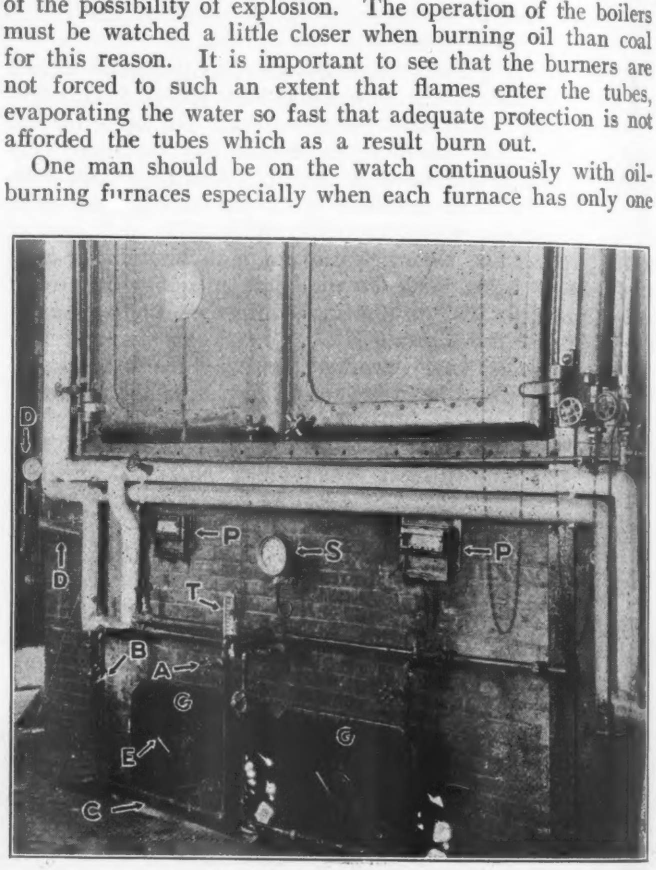


Fig. 3—300-Hp. Boiler Equipped with Engo Oil Burners

burner. Otherwise that burner might accidentally go out and the accumulated oil spray fed into the furnace create an explosive mixture.

Advantages from Burning Fuel Oil

The results secured at the Southampton street enginehouse power plant with oil-burning equipment have demonstrated the following important advantages: There is an increase in boiler capacity owing to more continuous operation and greater capacity for overload. The cost of fuel oil is roughly about the same as the cost of coal but there is a material saving in the labor formerly required to handle coal and ashes. Owing to the intense heat of the fuel oil flame, fire brick burn out, but not more rapidly than they are knocked out with the slice bar when burning coal. Boiler operation is more flexible with fuel oil, allowing a quicker response to sudden demands for steam. More accurate control of smoke is afforded, a particular advantage in the vicinity of large cities having smoke ordinances. The fire can be put out instantly with no loss of fuel such as occurs in banking a coal fire. It is possible to get more heat with less draft, the stack draft in this case being .15 in. and the furnace draft, .07 in. In addition, the boiler room can be kept in a much cleaner and more presentable condition with a favorable effect on the morale of the boiler room force.

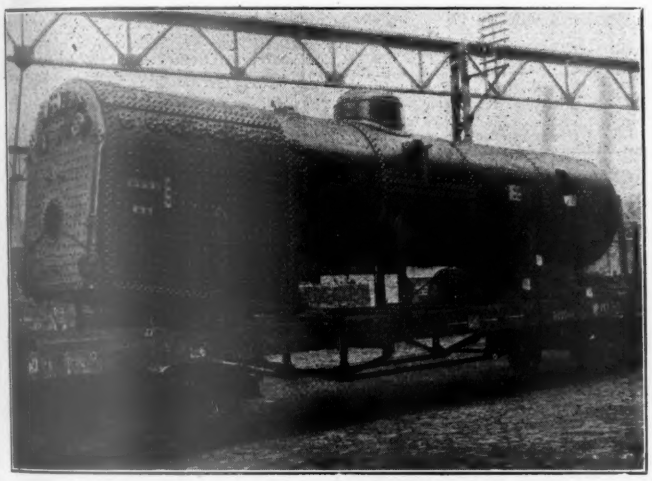
The British Secretary of State for the Colonies has given his approval of the construction of a new railway in the central province of the Gold Coast Colony, according to Department of Commerce cables.

Consolidation Locomotive for the Polish State Railways

By J. Dabrowski

The new plant of the first Polish Locomotive Works at Chrzanow, Poland, a brief description of which was given in the *Railway Mechanical Engineer*, September, 1922, has been completed and locomotives are now being delivered. The Polish Government placed an order with this company for the construction of 1,200 locomotives, deliveries to extend over a period of 10 years. The order included several types of locomotives for both freight and passenger train service. The first locomotives to be built are of the Consolidation or 2-8-0 type for handling freight traffic.

As the boiler shop of the locomotive works was not completed for operation as soon as the machine and erecting shops, the boilers for these Consolidation type locomotives are being built by the oldest boiler construction plant in the country, W. Fitzner and K. Gamper, Sosnowice, Poland. The photograph of one of these boilers loaded for shipment shows them to be of a good modern type.



Boiler for One of the Polish Consolidation Locomotives

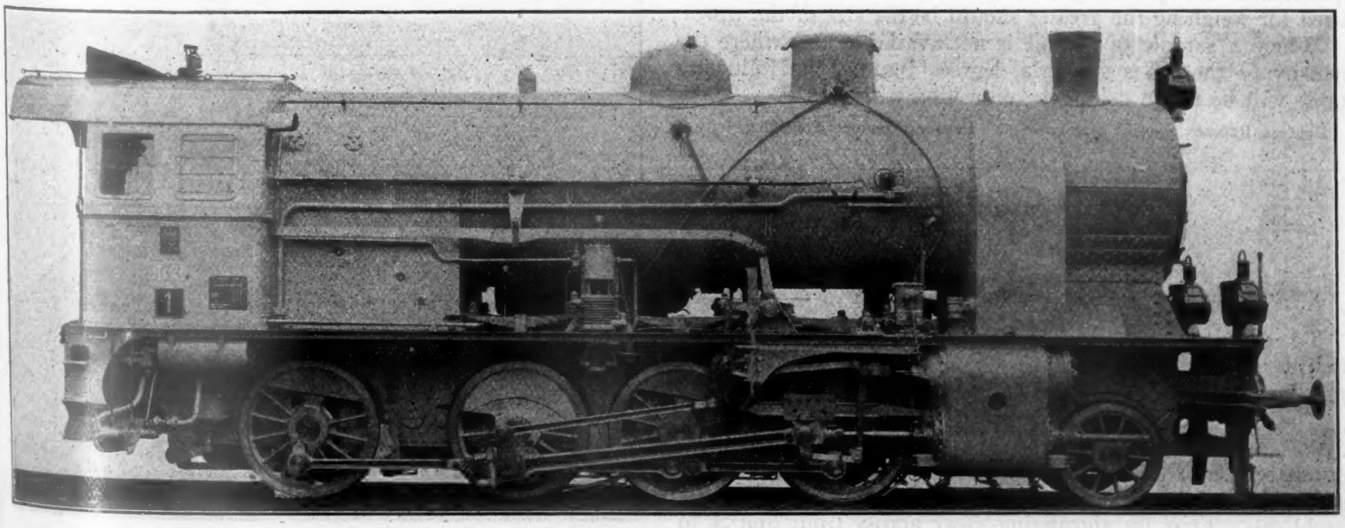
The 2-8-0 type locomotive is used extensively in Poland. An order for 150 locomotives of this type was given to the Baldwin Locomotive Works in 1920, and 25 additional locomotives of the same design were ordered subsequently. In the future, new locomotives will probably be built in Poland provided the capacity of the local plants is sufficient.

As conditions of track and bridges limit the axle load to 17 metric tons, the weight on the driving wheels of a Consolidation locomotive can not exceed 150,000 lb. New bridges, however, are being designed for axle loads of from 20 to 25 tons. The tendency in Poland is toward larger freight cars and heavier train loads than in most other European countries. A considerable number of 30-ton freight cars are in service, many of them having been furnished by American builders.

The new Polish locomotive illustrated is equipped with a Schmidt superheater and a Knorr feedwater heater. Westinghouse air brakes for drivers and train are also provided, the air brake now being applied to all new locomotives and cars, both passenger and freight. It has a greater cylinder horsepower, tractive effort and heating surface than the Baldwin locomotive, although the weight on the drivers differs but little. A comparison of the leading dimensions of the two designs is given in the accompanying table:

Dimensions, Weights and Proportions—Polish Consolidation Locomotive

Builder	Polish Works	The Baldwin Locomotive Works
Track gage	4 ft. 8½ in.	4 ft. 8½ in.
Cylinders, diameter and stroke	24.2 in. by 26 in.	21 in. by 28 in.
Weights in working order:		
On drivers	149,914 lb.	148,650 lb.
On front truck	26,456 lb.	15,150 lb.
Total engine	176,370 lb.	163,800 lb.
Tender	105,820 lb.	117,500 lb.
Wheel bases:		
Driving	16 ft. 7 in.	15 ft. 6 in.
Total engine	24 ft. 11 in.	23 ft. 8 in.
Total engine and tender	55 ft. 5 in.	57 ft. 3⅞ in.
Wheels, diameter outside tires:		
Driving	53¼ in.	56 in.
Front truck	39⅜ in.	33 in.
Boiler:		
Type	Straight top	Straight top
Steam pressure	184.9 lb.	191.7 lb.
Diameter, first ring, outside	71 in.	70 in.
Length over tube sheets	16 ft. 3⅝ in.	13 ft. 9¼ in.
Grate area	44.3 sq. ft.	32.1 sq. ft.
Heating surface:		
Total evaporative	2,250 sq. ft.	1,862 sq. ft.
Superheating	633 sq. ft.	420 sq. ft.
Comb. evaporative and superheating	2,883 sq. ft.	2,282 sq. ft.
Tender:		
Water capacity	5,546 gal.	5,400 gal.
Fuel capacity	17,600 lb.	23,140 lb.
General data estimated:		
Rated tractive force, 85 per cent	45,180 lb.	35,925 lb.
Cylinder horsepower (Cole)	1,945	1,520
Weight proportions:		
Weight on drivers ÷ total weight engine, per cent	85	90.7
Weight on drivers ÷ tractive force	3.32	4.14
Total weight engine ÷ cylinder horsepower	90.7	107.8
Boiler proportions:		
Comb. heat. surface ÷ cylinder horsepower	1.48	1.50
Tractive force ÷ comb. heat. surface	15.67	15.74
Tractive force × dia. drivers ÷ comb. heat. surface	834	882
Cylinder horsepower ÷ grate area	43.9	47.4



First Locomotive Built in Poland for the Polish State Railways

Will It Pay to Burn Oil Instead of Coal?

By W. F. Schaphorst

THE accompanying simple and handy chart will assist in deciding this question. To use the chart it is merely necessary to zigzag across as indicated by the dotted lines and line *G*, which is pointed at by the arrow at the right tells the number of B.t.u. obtained for each cent spent for coal or oil. In figuring oil begin at the top and zigzag down to line *G*. In figuring coal begin at the bottom and zigzag up to line *G*.

If the oil, for instance, costs five cents per gallon, contains 20,000 B.t.u. and the specific gravity is 0.9 and if the boiler efficiency with oil fuel is 80 per cent the zigzag dotted line shows that each cent will buy 24,000 B.t.u. Begin at 5 cents, line *A*, and run through 80 per cent, line *B*, with a straight line projected to intersect line *C*. From this intersection project a line through 20,000 B.t.u., line *D*, until it intersects line *E*. From this last intersection go through 0.9, line *F*, and the final intersection with line *G* gives the answer—24,000 B.t.u. for each cent.

Now comparing with coal, if coal costs $8 per ton of 2,000 lb. and if the boiler efficiency, using the same boiler as above, is 70 per cent with coal and if each pound of coal contains 11,000 B.t.u. each cent will buy about 19,200 B.t.u. as shown in line *G*. As will be noted the $8 is found in line *L*, and 70 per cent boiler efficiency in line *K*. Run a straight line through both points and locate the intersection in line *J*. Run a straight line through 11,000 in line *H* and the intersection with line *G* gives 19,200 B.t.u. for each cent.

In other words the solution of this problem indicates that the use of this oil at 5 cents per gallon will furnish nearly 5,000 B.t.u. more for each cent than will coal at $8 per ton.

In using line *A* the cost per gallon should include all costs—cost of hauling, cost of storing, etc.

It is well known that boiler efficiencies with oil are usually greater than with coal. The difference often is as much as 10 per cent as in this problem where we use 80 per cent in line *B* and 70 per cent in line *K*.

Regarding the specific gravity given in line *F*, an easy way to determine this is to take any vessel such as a pail, jug, or bottle, and weigh it. Then fill it with water and weigh again. Empty out the water, fill with oil and weigh once more. Subtracting the weight of the empty container, the weights of the water and of the oil are determined. Dividing the weight of the oil by the weight of the water, the quotient is the specific gravity. The less delicate the scales used for weighing the greater should be the size of the vessel.

Where a sample of the oil is not available and where the density of the oil is given in degrees Baume, the following table will be found useful in connection with line *F*.

Degrees, Baume	Specific gravity	Degrees, Baume	Specific gravity
10	1.0	55	0.76
15	0.97	60	0.74
20	0.93	65	0.72
25	0.90	70	0.70
30	0.88	75	0.68
35	0.85	80	0.67
40	0.82	85	0.65
45	0.80	90	0.64
50	0.78	95	0.62
..	...	100	0.61

To calculate the specific gravity, knowing the degrees Baume, simply add the degrees Baume to 130 and divide the sum into 140. The quotient is the specific gravity.

The cost of coal, line *L*, is similar to line *A* and must include all costs such as hauling, storing, pulverizing, and if purchased some time ago the interest on the purchase price.

This chart may be used in several ways for solving various problems. Thus by zigzagging clear across from line *A* to line *L* knowing the cost of oil and all the necessary intermediate factors, line *L* gives the equivalent cost of coal. Or zigzagging up from line *L* we get the equivalent cost of oil. Thus with coal at $6 per ton and the boiler efficiency at 70 per cent we would find that a heat value of 10,300 B.t.u. per pound of coal would give us no advantage in using oil as

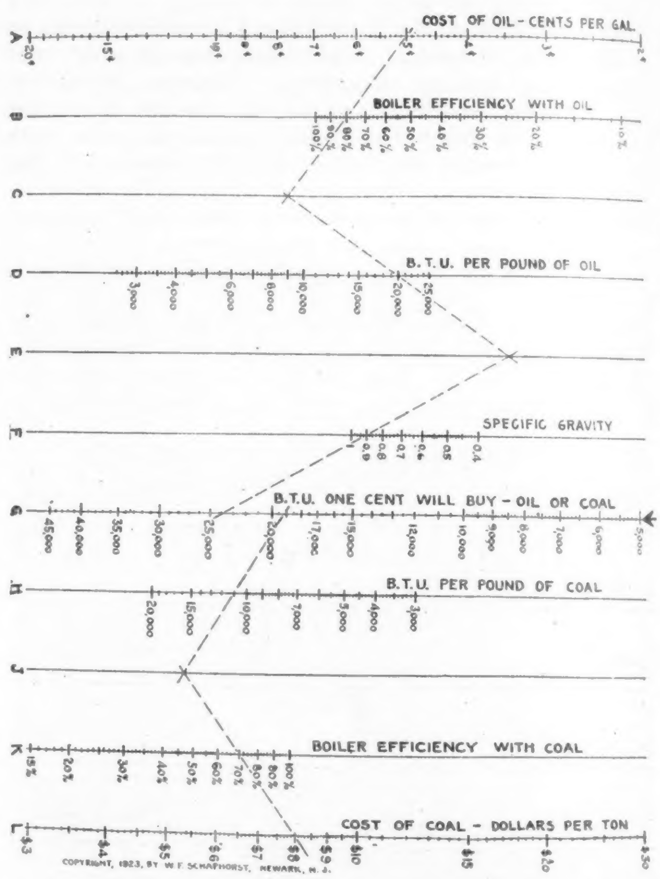
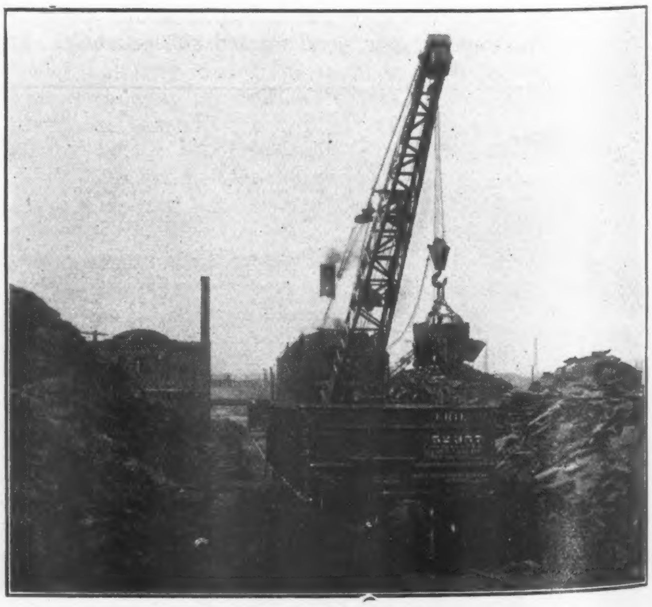


Chart for Determining Relative Value of Coal and Fuel Oil

regards cost of oil. But oil has other advantages such as less labor needed for firing, less storage space required, etc. All of these points, must be given consideration before one can decide that oil should be used in preference to coal or vice versa.



Ohio Electro Magnet Proves Value in Handling Tangled Scrap

Rules Governing Care of Stationary Boilers*

1. Safety Valves: Great care should be exercised to see that these valves are ample in size and in working order. Overloading or neglect frequently leads to the most disastrous results. Safety valves should be tried at least once every day to see that they will act freely.

2. Pressure Gage: The steam gage should stand at zero when pressure is off, and it should show the same pressure as the safety valve when that is blowing off, if not, then one is wrong, and the gage should be tested by one known to be correct.

3. Water Level: The first duty of an engineer before starting, or at the beginning of his watch, is to see that the water is at the proper height. Do not rely on glass gages, floats or water alarms, but try the gage cocks. If they do not agree with water gage, learn the cause and correct it. Water level in Babcock & Wilcox boilers should be at center of drum, which is usually at middle gage. It should not be carried above.

4. Gage Cocks and Water Gages: Must be kept clean. Water gage should be blown out frequently, and the glasses and passages to gage kept clean.

5. Feed Pump or Injector: These should be kept in perfect order, and be of ample size. No make of pump can be expected to be continuously reliable without regular and careful attention. It is always safe to have two means of feeding a boiler. Check valves and self-acting feed valves should be frequently examined and cleaned. Satisfy yourself frequently that the valve is acting when the feed pump is at work.

6. Low Water: In case of low water, immediately cover fire with ashes (wet if possible) or any earth that may be at hand. If nothing else is handy use fresh coal. Draw fire as soon as it can be done without increasing the heat. Neither turn on the feed, start or stop engine, nor lift safety valve until fires are out, and boiler cooled down.

7. Blisters and Cracks: These are liable to occur in the best plate iron. When first indication appears there must be no delay in having it carefully examined and properly cared for.

8. Fusible Plugs: When used, must be examined when boiler is cleaned, and carefully scraped clean on both the water and fire sides, or they are liable not to act.

9. Firing: Fire evenly and regularly, a little at a time. Moderate thick fires are most economical, but thin firing must be used where the draught is poor. Take care to keep grates evenly covered, and allow no air holes in fire. Do not "clean" fires oftener than necessary.

10. Cleaning: All heating surfaces must be kept clean outside and in, or there will be a serious waste of fuel. The frequency of cleaning will depend on the nature of fuel and water. As a rule, never allow over 1/16-in. scale or soot to collect on surfaces between cleanings. Handholes should be frequently removed and surfaces examined, particularly in case of a new boiler, until proper intervals have been established by experience.

The Babcock & Wilcox boiler is provided with extra facilities for cleaning. For inspection and washing, remove handholes at both ends of tubes, and by holding a lamp at one end and looking in at the other, the condition of the surface can be fully seen. Run the rotary flue cleaner through the tube until it is clean and free from sediment. In replacing hand-hole caps, clean surfaces without scratching or bruising, smear with oil, and screw up tight. Examine mud-drum and remove sediment therefrom.

The exterior of tubes can be kept clean by the use of blowing pipe and hose through openings provided for that purpose, and must be given frequent attention. In using smoky fuel, it is best to occasionally brush the surfaces when steam is off.

11. Hot Feed-Water: Cold water should never be fed into any boiler when it can be avoided, but when necessary it should be caused to mix with the heated water before coming in contact with any portion of the boiler.

12. Foaming: When foaming occurs in a boiler, checking the outflow of steam will usually stop it. If caused by dirty water, blowing down and pumping up will generally cure it. In cases of violent foaming, check the draft and fires.

13. Air Leaks: Be sure that all openings for admission of air to boiler and flues, except through fire, are carefully stopped. This is frequently an unsuspected cause of serious waste.

14. Blowing Off: If feed water is muddy or salt, blow off a portion frequently, according to condition of water. Empty the boiler every week or two, and fill up afresh. When surface blow-off cocks are used, they should be often opened for a few minutes at a time. Make sure no water is escaping from the blow-off cock when it is supposed to be closed. Blow-off cocks and check valves should be examined every time the boiler is cleaned.

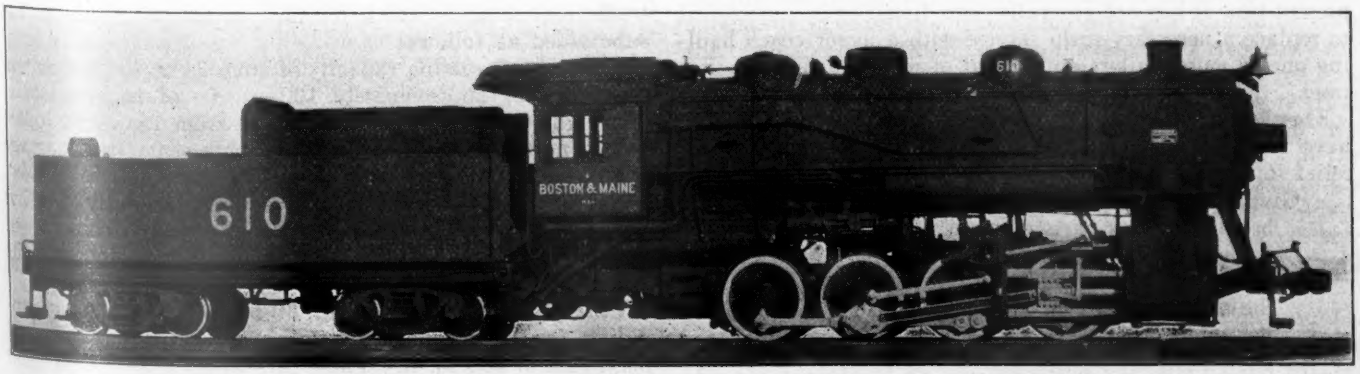
15. Leaks: When leaks are discovered, they should be repaired as soon as possible.

16. Blowing Off: Never empty the boiler while brickwork is hot.

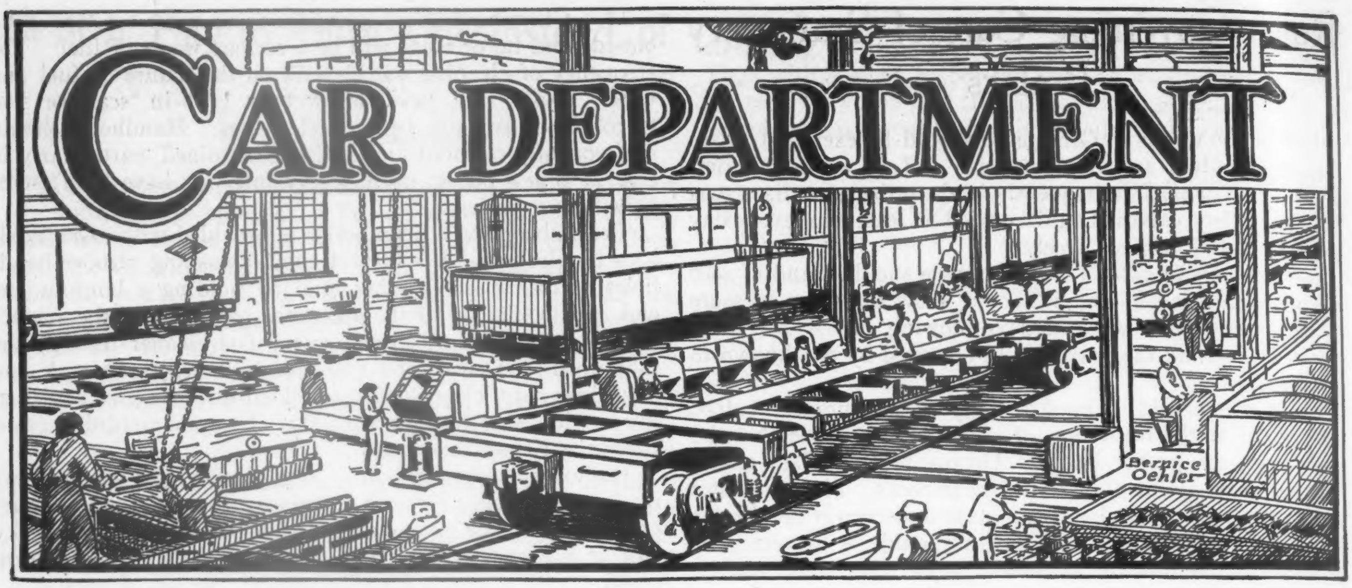
17. Dampness: Take care that no water comes in contact with exterior of the boiler from any cause, as it tends to corrode and weaken the boiler. Beware of all dampness in seatings or coverings.

This report was prepared by a committee consisting of J. J. Davey, N. P., chairman; Charles Zeitz and George C. Nicol, A. T. & S. F.

* From a committee report of the Master Boiler Makers 'Association, submitted at the May, 1923 convention, Detroit, Mich.



Eight-Wheel Switcher for the Boston & Maine, Built by the American Locomotive Company



Recent Developments of the Motor Coach*

Reasons for Renewed Interest—Advantages and Disadvantages of the Various Types—Performance Data

By C. E. Brooks
Chief of Motive Power, Canadian National Railways

THE motor coach is not a new departure but is one which has sunk back from a promising start 15 years ago into obscurity due essentially to high maintenance and operating costs. During the past three years, however, interest in the subject has been actively revived as a result of

a The ever-increasing encroachment of the motor bus on railway earnings

b The improvement in the design of the motor and its appurtances, and

c The attitude of the public, which the automobile is rapidly convincing that plush seats are not necessary when traveling short distances.

In order to enter into a discussion of present-day developments it will be necessary to outline briefly the service requirements, and in doing so the motor coach is presented as a "unit car" and not as a train of cars or a driving car hauling a trailer. The latter methods of operation may be possible on small interurban or suburban lines, but for practical transportation purposes they are not being considered by many large railways. The reason for this is that up to the present time it has not generally been found to be economical to replace a necessary train service with a motor coach hauling one or more trailers on account of motor-capacity limitations.

On the other hand, high train-mile costs for small returns have forced railway officials to turn to the motor coach for relief in the following classes of service:

a Giving a frequent passenger service on sparsely settled branch lines or parts of main line adjacent to market towns or junction points

b Connecting junction points on important main lines with the town or small city situated within a few miles of the main line

c Giving a group of towns situated on a main line or important branch lines a frequent connecting service over and above through main-line trains

d Connecting small summer resorts, golf clubs, etc., to branch-line or through main-line service

e Handling milk of a limited amount to a distributing or connecting point

f Providing connections to small suburbs.

Among the first real developments of the motor coach was the gas-electric car, the use of which spread rapidly 15 years ago but which unfortunately did not solve these problems successfully on account of high maintenance cost of the heavy-duty gasoline motor, uncertain service, complications of equipment, and great weight of the coach itself.

About the same time steam units having considerable weight and all the complications of the locomotive appeared, but were discarded for much the same reason.

Classification of Present-Day Developments

Present-day developments are generally to provide for traffic requirements which for the purpose of discussion are subdivided as follows:

Class A—A seating capacity of from 24 to 40 persons and provision for approximately 100 sq. ft. of baggage space. The light weight of such a car to be from 18,000 to 30,000 lb., or not to exceed 750 lb. per single seat (with baggage space) or 500 lb. per seat if no baggage space is allowed.

Smaller cars have been made and are in daily use, but considering the rapid development of traffic after cars are put into service, it is believed that the above-mentioned limits are reasonable.

Class B—Units seating from 40 to 60 passengers and providing for baggage space a minimum of 100 sq. ft. and maximum of 200 sq. ft. These cars weigh from 800 to 1,200 lb. per single seat, but it is thought that the weight must be

*Abstract of a paper presented at the Montreal meeting of the American Society of Mechanical Engineers, May, 1923.

kept down to the same limits as those prescribed for Class A in order to get fuel economy and keep maintenance costs at a reasonable figure.

Speed Requirements. Schedule speeds of 15 to 25 m.p.h. including stops. Consider a 5-mile run between stops and 1 min. for stops: Acceleration from 0 to 30 m.p.h. in 2 min. on level track, 30 to 35 m.p.h. at end of third minute, an average speed of 35 m.p.h. for the next 3¾ miles and 0.5 min. to travel 0.21 mile and come to a stop, means that in order to run 5 miles and make one stop the elapsed time is 10.9 min., or an average schedule speed including stops of 27½ m.p.h. This allows nothing for loss of time on gradients, slow orders, etc.

Generally speaking, Class A units have been gasoline-driven, and experience goes to show that this class of equipment is an economical and lasting development which will be improved to the point of high-grade automobile reliability within a short time. Already in many places these cars have retrieved business which had been lost to bus lines on the highways and also to the privately owned car, and it has been the usual thing to find that passenger traffic develops to a marked extent after a service has been instituted.

Canadian National Gasoline-Driven Motor Coach Built by Service Motor Truck Company

The failures have been rather heavy due to conditions described later in this paper, to the overexacting requirements of time tables, and to non-realization of the limitations of the gasoline motor.

For the purpose of description Class B units may generally be subdivided into (*a*) storage-battery, (*b*) steam, (*c*) heavy-duty gasoline-engine, and (*d*) gas-electric cars.

Class A Cars

Gasoline-Engine-Driven Motor Coach. For Class A cars weighing approximately 30,000 lb. light weight, the general practice has been to use a 4-cylinder truck engine running at a maximum speed of approximately 1,600 r.p.m. and developing a maximum of 70 hp. Wherever this type of engine has been used it has transmitted its power through clutches, transmissions, and universals to gears, most of which are of standard truck or even heavier design.

A general description of a typical power plant such as mentioned above is as follows:

Engine, 4-cylinder, 4¾ in. by 6 in.
Pressure oiling system.
Pump water-cooling system.
Primary and secondary transmission.
Primary ratio: first speed, 4 to 1; second speed, 1 to 1.
The secondary increases the ratio from 26 m.p.h. for normal engine speed to 35 m.p.h. The first provides for ruling-grade and the second for level-track conditions.

To a much less extent the automobile-type six-cylinder engine of the following general description has been experimented with:

Engine, 6-cylinder, $3\frac{3}{16}$ in. by 5 in.
Pressure oiling system.
Gear ratio, 4.7 to 1 between engine and wheel.
Nominal engine speed at 30 m.p.h., 1,450 r.p.m.
Horsepower developed, 50 at 2,200 r.p.m.
Maximum speed, 2,200 r.p.m.
Pump water-cooling system.

In general its power has been transferred through standard automobile clutches, transmissions, etc., which are used with the same type of engine in automobile service.

So far as the actual power plant is concerned, it is the opinion of many that the automobile engine has in almost every way demonstrated its superiority over the truck engine for Class A cars and for general service because of its ability to run over rated speed without serious loss of balance and consequent excessive vibration, and its economy under light load conditions. The first of these reasons undoubtedly embraces conditions which are vital to the successful maintenance of any machine or engine.

Practically any high-grade automobile engine designed for a rated engine speed of approximately 1,450 r.p.m. at 30 m.p.h. with a gear ratio between 4 to 1 and 5 to 1 may be driven at engine speeds of 2,200 r.p.m. and car speeds of from 50 to 60 m.p.h. without any noticeably serious vibration. Experience indicates that a similar flexibility cannot be expected from truck engines for any length of time without serious engine trouble developing and possibly resulting in a complete breakdown.

When a motor coach is being operated where there are schedule connections to make and where there are meeting points designated by train orders and by time card, it is certain that, regardless of the framing of a schedule, which should not develop an engine speed over that coinciding with the rated speed of 35 m.p.h., the operator will frequently exceed this by 15 or 20 m.p.h. in order to meet the requirements of the service after a delay. There is nothing parallel to this in highway work with either the automobile or the truck, but it is such an accepted fact on a railway that the only safe course is to provide the type of power plant which will meet these requirements daily without breaking down. Railway gradients even accentuate this condition, as there is practically no opportunity for letting the engine cool off as there is on the highway.

The automobile engine has been designed not only for easy and economical low-engine-speed conditions, but also for those outlined in the preceding paragraph, and the experience of several railways with a number of cars operating

under extremely different conditions seems to bear this out, which leads to the conclusion that the lightweight, high-speed gasoline engine is a satisfactory power plant for the lightweight cars.

Class B Cars

Storage-Battery Car. The general data of a typical unit are as follows:

Car. Interior arrangement to suit purchaser; weight, 60,000 lb.; length, 53 ft.
Trucks. Two 4-wheel standard M.C.B. axles, except that journals are fitted with roller or ball bearings.
Electric Motors, Etc. Four 25-hp. motors (250-300-volt) mounted with a gear ratio of 16 to 91. Standard series and parallel controller and circuit breaker installed at each end and in baggage compartment; provided with voltmeter, ampere-hour meter, underload circuit breaker and switches for control of air compressor and lighting.
Storage Batteries. 250 cells, capacity 450 amp.-hr. at 300 volts, or 145 kw.-hr. (580 amp.-hr. have been obtained with a minimum of 150 volts).
Battery Charging. Direct current at 250 or 500 volts may be used for charging, and the car is equipped with switches for arranging the battery cells in either series or parallel. Normal rate of charging, 90 amp. Time required for a normal full charge, 5 to 7 hr. A higher rate of charging may be employed provided temperature of battery does not exceed 115 deg. F.
Radius of Operation. Maximum 140 miles on a full charge, figuring on level or rolling grade. Recommended not to exceed 100 miles without obtaining a boosting charge.
Power Consumption. Power required, 35 watt-hr. per ton-mile. Acceleration, ½ m.p.h. per sec. Maximum speed, 45 m.p.h. on level track. As the car weighs approximately 60,000 lb., 35 watt-hr. per ton-mile is equivalent to 1.05 kw.-hr. per car-mile for level track and normal conditions.

Within the above-mentioned radius of operation this car has been extremely satisfactory and is being operated successfully under low-temperature conditions with no appreciable trouble. Its tractive effort of 2,400 lb. makes it possible to use a trailer if necessary. The cost of operation, including all maintenance and transportation charges, power, etc., is 17 cents per car-mile. The maintenance has been extremely light, and all indications are that the life of the batteries will be eight to ten years at least.

Steam Cars. The steam power plant was probably the first to be tried for self-propelled cars, but unfortunately its development has not kept pace with requirements. Medium-pressure (300 to 400 lb.) boiler plants with comparatively low superheat (100 deg. F.) were introduced to a considerable extent in continental practice several years ago, but the use of the steam car has not developed, due principally to excessive weight and complications of equipment, and inefficiency of the boiler plant.

Recent developments indicate that while the seriousness of these defects has been noted and improvements have been made, they have not yet been overcome to the point where steam power may be considered to be the most satisfactory unit car power, and it may be well to consider these defects more in detail as they appear to exist in modern equipment.

Insufficient boiler capacity is a defect directly coupled with excessive weight of equipment. Boiler plants of approximately 70 boiler hp. nominal rating have been applied to cars with a total net weight in running order of from 50,000 to 60,000 lb. and providing for 100 sq. ft. of baggage space. The total live load will bring this equipment up to a gross weight of approximately 65,000 lb. or a load of 650 lb. per boiler horsepower.

Experience indicates that for a boiler of this capacity the weight should be reduced by approximately 15,000 lb., and this should be possible as the entire power plant may be carried on the leading (driving) truck and the remainder of the body lightened proportionately. Total absence of vibration should be a great advantage in lightening the car equipment.

Practically all the first cars of continental make indicated that high pressure and high superheat were necessary in order to provide for a gear ratio sufficient for starting and at the same time for a piston speed of 800 ft. per min. at 40 m.p.h. The engine developed to meet these conditions has no doubt been a great mechanical success, but the boiler plant supplying it has not yet been developed to the point where it can exceed the schedule previously outlined, even under the most favorable conditions. The causes of this deficiency appear to be due mainly to the two following defects:

a Insufficient header volume, resulting in carrying over an emulsion into the superheater units, with a consequent total loss of superheat and excessive water consumption, and

b Unequal distribution of heat to all generating units, resulting in steam pockets and thereby destroying both circulation and evaporative qualities.

The problem of providing sufficient surface-condenser capacity for hot-weather conditions coupled with protective appliances which will be operated by thermostat in cold weather has not been solved, with the result that under maximum conditions the water loss is as high as 45 lb. per car-mile, necessitating replenishing at frequent intervals and a consequent loss of time.

Automatic control of the oil flame has been highly developed but is not yet perfected. Generally speaking, this automatic feature must have two distinct functions: Namely, (*a*) cutting off or reducing the fuel supply when maximum boiler pressure is reached, and (*b*) cutting off fuel under low-water conditions. The first is undoubtedly perfectly developed but the second is not, due to the varying quality of the steam coincident with the condition (maximum load) which most often causes low water.

The least considered of all conditions in connection with the steam car are probably those affecting the comfort of the operator, and in this respect it is unpopular on account of the extreme heat which may be experienced and also the noise of the oil flame. The latter is by far the most serious, and it is apparently impossible to control it when using high-velocity jets of steam for atomizing.

Space does not permit a further study of the steam plant, but the following general data of a steam car now being tested may be of interest.

Space required for boiler plant, sq. ft.	640
Heating surface of boiler, sq. ft.	385
Heating surface of superheater, sq. ft.	44
Gross weight of car, lb.	60,000
Net weight of complete power plant without oil and water, lb.	13,000
Quantity of water supply, U. S. gal.	200
Quantity of oil supply, U. S. gal.	180
Gallons of oil per car-mile, average	1
Boiler pressure, lb. per sq. in.	800
Superheat, average, deg. F.	200
Engine dimensions	6½ in. bore by 8 in. stroke
Gear ratio between crankshaft and axle	1 to 1.46

Heavy-Duty Gas Car. The general data of a car of this type are as follows:

Car. Length, 55 ft.; weight, 66,000 lb. loaded.
Engine. 6-cylinder, 6¾ in. stroke. Power, 116 hp. at 800 r.p.m. and 225 hp. at 1,600 r.p.m.
Transmission. Four speeds forward, three reverse; geared to give 56 m.p.h. forward at 1,400 r.p.m. in high and 37 m.p.h. in third speed.

This class of car has not been tested to the point where any accurate data may be given, but it is evident that the gasoline consumption will be at least twice that of a Class A car per car-mile. The problem of handling through transmission and clutch the mechanical drive from a gasoline engine of possibly 200 hp. has not yet been solved unless it may be through the medium of the oil transmission so successfully used in navy work. However, the complication of this transmission or magnetic control makes it doubtful at the present time whether gasoline power plants will successfully exceed 70 hp. in capacity.

Gas-Electric Car. Mention has already been made of the car of this type which came into prominence about fifteen years ago and which was practically discarded on account of its unreliable power plant and general complication.

The first-mentioned cause of failure has undoubtedly been overcome and reliable constant-speed units are now in general use for generating purposes. If it were possible to eliminate the starting troubles when using types of engines suited for low-grade and cheap fuels, there would be no doubt about the general use of this type of equipment on account of unit power costs. The difficulties mentioned are such an important factor in the successful operation of a motor coach that we must necessarily turn to the gasoline engine.

The gas-electric system provides double-ended control and

an efficient starting torque but still retains all the complications of a dual power plant.

The general data of a modern gas-electric car may be started as follows:

Car. Length, 55 ft.; width, 10 ft.; seating capacity, 54 with 100 sq. ft. of baggage space; weight loaded, 65,000 lb.

Engine. 6-cylinder, governor-controlled, 7 in. bore by 8 in. stroke; develops 150 b.hp. at 900 r.p.m. and drives a 100-kw. 700-volt generator which in turn drives two motors on forward truck. Fuel consumption (estimated), 0.25 gal. per mile.

It is thought that there may be a possibility of employing a smaller-capacity constant-speed gasoline engine (average running power consumption approximating 25 hp. for cars weighing 60,000 lb. loaded) which will drive a generator charging a limited battery capacity. Theoretically this might provide the starting torque desired and at the same time eliminate the undesirable features of the large power plant, but it could not be an economic consideration where cheap power could be purchased.

Ball and Roller Bearings have been one of the important factors in the development of the motor coach. Exhaustive tests indicate that the ball bearing has reduced starting friction under summer conditions to approximately 15 per cent of that of plain bearings, or in other words has reduced friction of approximately 20 lb. per ton to 3 lb. per ton. At the same time the average rolling friction at speeds up to 30 m.p.h. has been reduced by approximately 40 per cent, or from 3.6 lb. per ton to 2.2 lb. per ton.

Experience indicates that the ball bearing is suitable for Class A cars, but that the areas and sizes for designed industrial work should be at least doubled for railway work due to excessive shocks and side thrusts. It is not possible at present to say whether side thrusts are more destructive than vertical rail shocks, but it is certain that for poor rail conditions the bearings should have a side-thrust capacity of 100 per cent of the vertical load.

For Class B equipment it may be necessary to use roller bearings for vertical loads in connection with special bearings for side thrusts.

Transmission and Type of Drive

While it has been stated that the automobile engine is most suitable for the light motor coach, it must nevertheless be admitted that experience indicates that standard automobile transmissions, clutches, universal connections and driving gears are entirely inadequate for motor-coach service and are the cause of probably 75 per cent of the breakdowns. Similar parts which have been developed for truck engines are generally much superior due to their greater size and strength per horsepower transmitted.

The argument has been advanced that the parts are designed for the engine and will handle all the power developed by it; but this contention is not sound, because the greater inertia to be overcome at starting requires a momentary torque much in excess of anything experienced in automobile work.

Account must also be taken of the fact that in this country and the northern part of the United States cars have to be operated in snow storms, resulting in clutch slippage and shocks to transmission which are much in excess of those experienced in automobile service.

The method employed in transmitting the power to the wheels has generally been one of the following:

1. Through a standard transmission to one driving axle which supports the entire two-wheel rear truck and which can move in a vertical plane only. While this is the simplest method of driving, it is not the opinion that it will ever be generally acceptable as experience indicates that safety and good riding qualities are almost proportionate to the number of wheels in the trucks. This is particularly applicable to cars operating on cheaply maintained lines.

2. To both axles of the front four-wheel truck by gearing and universal connections from a transmission located behind the truck. Experience on some railways goes to show that this method is successful, and although the number of universal connections is not reduced the shafts are all short and the driving forces are removed from the passenger-carrying part of the cars, thereby reducing vibration.

Canadian National Motor Coach Driven by a Reo Six-Cylinder Automobile Engine

3. To a transmission located at about the center of the car and from there to nearest axle of each four-wheel truck or to both axles of two-wheel trucks. The advantage claimed is that the entire weight of the car is available for adhesion (where the trucks are of the two-wheel type) but general experience indicates that this is not necessary and is harder on the engine than where part of the momentum of rotating parts may be taken up by slippage. Where four-wheel trucks are used this method has been found to give better adhesive qualities than connecting to both axles of one truck, but the advantage seemingly is not sufficient to warrant the extra complication.

4. To leading axle of rear four-wheel truck. The chief advantage of the drive to the rear truck is that the engine may be aligned in such a manner as to have its shaft center line pass through the center line of the main driving axle, thus reducing wear on the universals and friction. The disadvantage is that it necessitates the use of one or more supplementary bearings between the engine and the point where the drive shaft is coupled to the front universal. The maximum lateral motion of a truck of 48-in. wheel centers and 18-in. truck centers on an 80-ft. radius curve is shown to

average ¾ in. at a radius from the center of 24 in., so that it is apparent that the swing of the truck has but little effect on the universals. The torque arms supporting the housings of such an arrangement should have both vertical and lateral swing. Only when the load on the main axle is not sufficient for adhesion it may be conceived that driving power acts on the second axle. Under ordinary conditions transmitting power to the second axle generates no more friction than that due to the weight of rotating parts.

Methods of transmitting power from the front axle to the rear axle of rear truck may be subdivided as follows:

a Chain Drive. Chain drive has the disadvantage of rapid wear, noise, and the complication of shields and covers which more than overcome the advantage of the straight drive to the rear truck.

b Gear Drive. Gear drive to the second axle no doubt appears to be the best mechanical means of transmitting power, but it has all the disadvantages of rapid wear due to difficulty of adjustment of contact and the maintenance of extra universals.

c Side Rod and Cranked Wheels. Side-rod drive to the second axle, along with many other locomotive developments said to be crude and inefficient, in actual practice is a thoroughly reliable and easily adjusted and inspected arrangement, and is operating successfully at high and low speeds and with no appreciable friction.

d Miscellaneous, including oil transmissions that are still being experimented with.

Summary

There is no doubt a great difference of opinion regarding what type of motor coach will fulfil the requirements best. It is apparent that there will be important developments in railway motor cars, both as regards design and field of service, and therefore the following conclusions may be considered as preliminary only.

Class A Cars (30,000 lb. max. light weight), driven by automobile-type, 6-cylinder gasoline engines, should have the following general characteristics and limiting conditions: 1.6 hp. per 1,000 lb. light weight of car at engine speed of 2,100 r.p.m., giving a car speed of 35 to 40 m.p.h. Rolling friction, 2.2 lb. per ton of weight on rail, and wind resistance of 5 lb. per sq. ft. cross-sectional area of car at 40 m.p.h. Weight of car per passenger seat, maximum 750 lb.; weight of car per maximum hp., 600 lb. Gear ratio between engine and wheel for ruling grades not exceeding 1.25 per cent, 4.7 to 1. (In hard operating conditions this may be increased to 5.5 to 1.)

Class B Cars. It is difficult to come to a general conclusion with regard to this class of equipment, as it appears that only one class of car has actually passed the experimental stage. One Canadian railway has found the battery car to be a reliable and economical unit to operate, provided that the schedule will permit of charging time. Severe weather conditions have had little effect on the operation, and the simplicity of the power-controlling devices eliminates any chance of opposition from the operators.

The chief obstacles in the development of this type are the first cost and, in some regions, high power costs, but it is felt that the great advantage it possesses of double-ended operation without complication more than offsets any serious disadvantages.

In conclusion, it seems safe to say that there is a fairly large field for the motor coach in railway work and that it will not be developed from without but rather from within—slowly, conservatively, by motor manufacturers and railway engineers, as the traveling public will never tolerate from railway companies the difficulties and disappointments which have been visited on them by automobile manufacturers. The railway engineer to do his part in this problem must be familiar not only with operating conditions but also with the labor problems which are sure to arise in such a development, making it necessary and advisable to give consideration to the employee operating this equipment and to the public using it.

Discussion

L. Klopman (Railway Storage Battery Company): I agree with all that the author has said in favor of the storage-battery car, but that the paper did not go quite far enough in presenting its proved utility and service.

The author has divided self-propelled cars into two classes placing the storage-battery car in the heavier class (B) but excluding it from the lighter (A), or that for cars having a seating capacity of 24 to 40 passengers, a baggage space of approximately 100 sq. ft., and a car weight of from 18,000 to 30,000 lb. Storage-battery cars answering this description had been in successful operation since 1917 on the Chattahoochee Valley, on the Long Island since 1914, and elsewhere, which had a seating capacity of 32 to 40 passengers, a baggage space of 80 sq. ft., and a weight, including battery, of 28,000 lb. These cars had been equipped with two 25-hp. 175 to 250-volt motors, double and series-parallel control with a gear ratio of 5.29 to 1, and 150 A-12 Edison cells.

There was no reason why a storage-battery car such as this could not meet every test which had been successfully met by the gasoline-engine-driven motor coaches designated under Class A, and not only meet these conditions, but more economically and with greater reliability in operation than the gasoline car.

The multiplicity of troubles and complete failures which were inevitable with any kind of combustion engine and drive after considerable service necessitating shopping of equipment and consequent substitution, were matters worthy of serious thought.

This was to be compared with the simple, effective electric motor and control of the storage-battery car, which was as nearly absolutely foolproof as any mechanism yet devised. The four-motor drive permitted in the remote contingency of failure of even two motors, of the remaining two motors propelling the car. A mechanical or electrical failure of the battery was so remote as to require no consideration. Its initial cost was admittedly higher, but in a comparatively short period the low cost of maintenance both for the battery and the electric motors soon equalized the difference in the initial cost.

The life of the storage battery has proved to be over 10 years in this class of service and, in fact, cars were now in operation in Canada the batteries of which had been installed as far back as 1914. The condition of a gasoline engine started in the same service in that year could easily be imagined.

It was to be remembered that all storage-battery cars were equipped for double-end control, which meant both economy of time and money in operation. The author had cited the use of these cars to connect junction points, small summer resorts, golf clubs, etc. This service would hardly warrant the cost of installation of a Y or turntable such as the one-end operation of a gasoline motor car made necessary, and it was only fair that the cost of such installation be deducted from the initial cost of storage-battery operation.

So far as Class B cars were concerned, in stating the maximum radius of operations, the author had limited himself to the statement that its maximum radius of operation was 140 miles on a full charge. This statement was correct as far as it went, but cars of this size had made and were making up to 235 miles a day where facilities were available and operating schedules permitted time for intermediate charging. This would give the storage battery car a mileage which, for all practical purposes, was equal to that afforded by a gasoline engine driven car.

R. G. Gage (Canadian National) said that one of the

chief items that should be watched in connection with storage batteries was the first cost—not perhaps in the car itself, but in the different facilities for making low cost of operation. The charging facilities sometimes were difficult to procure. The question of operation of the storage battery car in Canada was important. At certain times of the year, with the temperatures which they had, it was absolutely necessary to start the car out properly charged, but in such cases it had been his experience that there was little trouble. That was one of the serious things that must be given consideration as regarded the proper scheduling, which those having to do with transportation were not always ready to realize.

J. A. Shaw (Canadian Pacific) stated that the railway company with which he was connected had installed four gasoline-engine-propelled cars, to transport passengers from the station to its hotel. They operated for four months each summer and carried all the supplies and fuel as well as passengers. The cost of gasoline for operation per annum was about $1,000.

Mr. Brooks, in closing, said that the chief reason why he believed that the gasoline-driven car was the most suitable to fulfil the requirements outlined for Class A cars was the requirements of the service.

These small units were often used in sparsely settled parts where the only hope railway companies had of making anything out of the service was in its frequency. His company had driven cars fitted with automobile engines on regular schedules which necessitated covering 360 miles per day, up to 50,000 miles before any appreciable repairs had been necessary to the engine.

It was necessary to differentiate between experience derived from highway-run service and mechanical equipment driven on steel rails. He felt sure, from what he had seen, that the life of a gasoline car motor running on steel rails would be five or more times that of a gasoline automobile motor on highway service.

It was necessary to remember that in Canada, where car batteries had to be imported, their cost would run close to $20,000. If necessary, the complete gasoline power plant in one of the Class A cars could be junked every year for practically the interest on that amount alone, without repayment of the cost of the batteries. It might appear at first that it was wise to figure on writing off the value of an automobile engine driving one of these small units after, say 50,000 miles. Experience had indicated, however, that it would be proper to allow 150,000 to 200,000 miles on that kind of service. But even if conditions were such as to make it advisable to junk the engine at the end of 50,000 miles, he still thought it would be better to do this rather than to incur the heavy expense for the storage battery, which necessitated a large investment in the charging equipment where cheap power could not readily be tapped. He appreciated the value of the storage-battery car, but felt that for certain classes of service it was necessary to have something cheaper and more flexible.

P. R. R. Combination Car

THE new all-steel combination cars for the Pennsylvania, Class PB-70, built at the Harlan plant of the Bethlehem Shipbuilding Corporation, Wilmington, Del., have a passenger compartment 34 ft. 9⅝ in. long, with seats for 44 persons and a baggage compartment 35 ft. 6 in. long. The length of the body is 77 ft. 8¾ in. The weight of

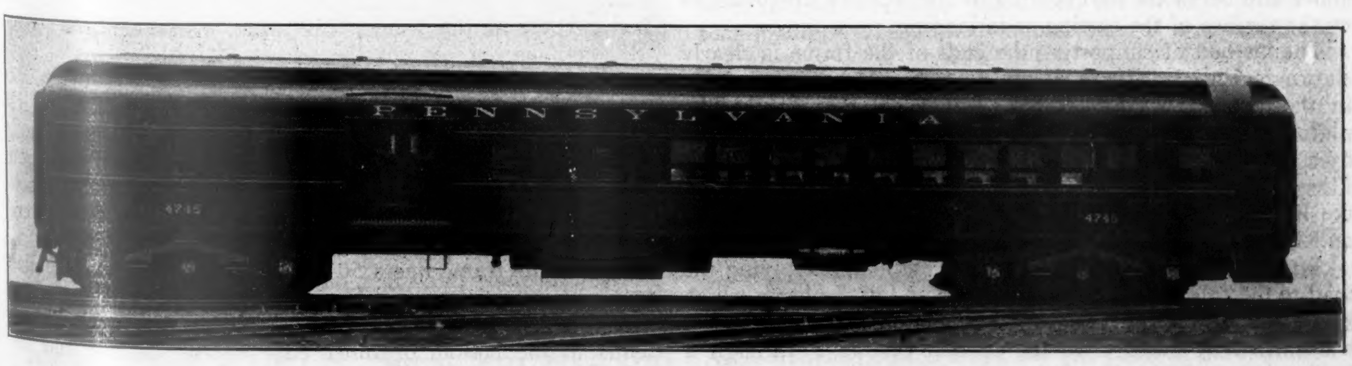
Interior of Pennsylvania Combination Passenger and Baggage Car

the car is 134,600 lb., of which the two trucks constitute 45,900 lb. These trucks, which are of the Pennsylvania patented six-wheel type, Class 1-D, have 36 in. steel wheels, 5½ in. by 11 in. journals and a wheelbase of 11 ft. 0 in.

The interior finish, including the ceiling, is in steel with Ceilinite on the back. The flooring is of Flexolith composition. The seats are Hale & Kilburn No. 194. Parcel racks of the continuous type are provided. Window fixtures and trap doors are of O. M. Edward's design.

The Gold Car Heating & Lighting system of steam heat is used in the passenger end and the Vapor Car Heating & Lighting system in the baggage end. The lighting equipment was furnished by the United States Light & Heat Corporation, the batteries being of the Edison type.

The couplers are type D, with Westinghouse type N-11 friction draft gear. Fowler upper buffer springs also are applied. The brake equipment is of the U C type, with 16-in. cylinders. The foundation rigging is of the Pennsylvania clasp-brake design furnished by American Foundries.



Pennsylvania Combination Passenger and Baggage Car Built at Harlan Plant of the Bethlehem Shipbuilding Corporation

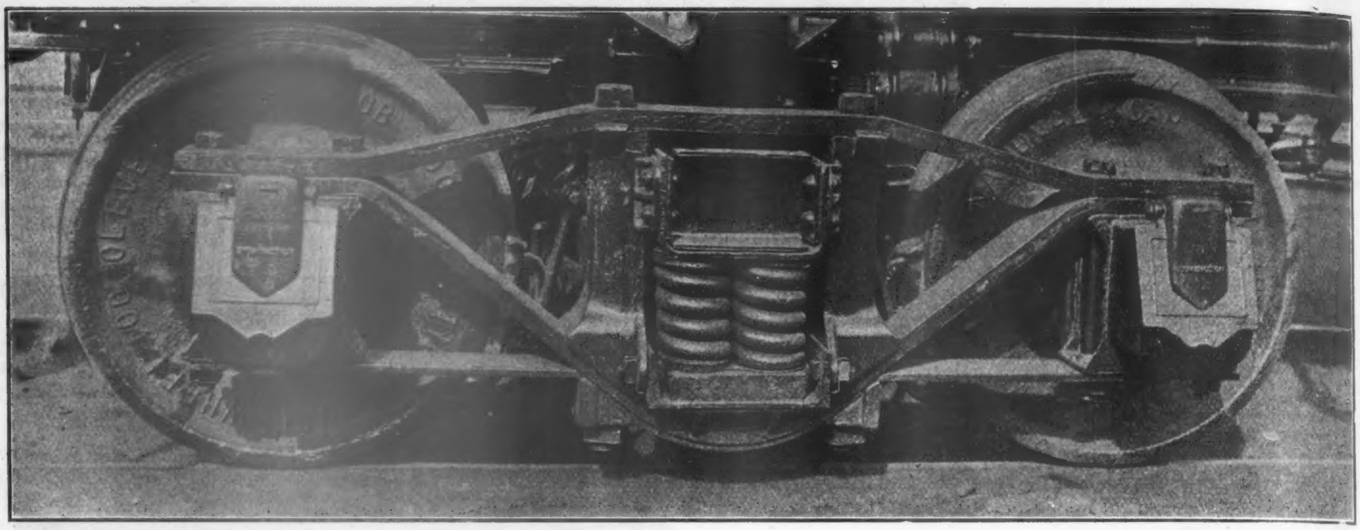


Fig. 1—Fifty-ton Truck with Improved Arch Bar Side Frame

Tests on Different Shaped Arch Bar Side Frames

Slight Changes in Design Reduce Unit Stresses from Over 40,000 Lb. to About 20,000 Lb.

By Louis E. Ensley
Professor Railway Mechanical Engineering, University of Pittsburgh

THE purpose of the tests described was to determine the stress set up in different shaped arch bar truck side frames under direct vertical load, transverse load and twisting load. The loads used were—for the 50-ton trucks, 68,500 lb. vertical load, transverse load of 9,000 lb. and a twisting load of 6,000 lb., applied at the center of the truck spring seat. For the 70-ton truck tested the load was for the direct vertical load, 95,000 lb., transverse load 12,600 lb., twisting load of 8,400 lb., applied at the center of the truck spring plank.

Machine and Instruments

The tests were conducted at the plant of the Pressed Steel Car Company, located at McKees Rocks, Pa. The machine used was their 600,000 lb. Olsen testing machine. A photographic reproduction of the frame under test is shown in Fig. 2. A direct vertical load was transmitted to the spring seat of the side frame by a cast steel foot *A* to a 1-in. by ⅜-in. by 10-in. strip of iron lying over the center line of the spring seat. The load then acted through a 1½-in. by 6-in. by 8-in. filler block to a circular ball bearing which rested on the spring seat. A wooden block about ¼ in. thick was used above and below the ball bearing to take up any irregularities on the surface of the casting or in loading.

The method of supporting the ends of the frame is clearly shown in Fig. 3. The block *L* took the place of the wedge in the journal box, the block just below that taking the place of the brass. This lower block was also knife edged by a circular groove in the short axle *J* which is supported by filler blocks on the casting *K*. Great care was taken to insure the line of force passing through the center of the arch bar and half way between the two journal box bolts.

A transverse load was obtained by manually applying the load to the calibrated spring *B* at each end of the beam which was anchored to the frame by means of bolts *D* and *E* and transmitted by beam *C* to the column casting *F* through a knife edge at the center of the column. To apply a twisting load, the calibrated spring *G* received a load and transmitted it to the ball-crank *H* turn buckle *I* and thus to the spring plank.

The instruments used for determining the stress throughout the frame under the different loads were the Berry strain gages. These are clearly shown clamped on the frame in Fig. 3. These gages are so constructed that the elongation per inch can be accurately determined to .0001 of an inch.

Description of the Side Frames

This report covers the tests of five different arch bar side frames, four of them were for 50-ton and one was for a 70-ton car. No. 1 was a 50-ton standard ARA frame which had top and bottom arch bars 5 in. by 1½ in. and a ⅝-in. tie bar. An outline of the frame is shown in Fig. 4.

No. 2 frame shown in Fig. 5 was a Pennsylvania standard 50-ton arch bar side frame with a top and bottom arch bar of 5 in. by 1¼ in. and a ⅝-in. tie plate. This frame is much like the ARA frame but the bars are only 1¼ in. thick instead of 1½ in. as in the ARA 50-ton frame and the radius at the bottom bend of the lower bar is 2⅞ in. instead of 1½ in. as in the standard ARA arch beam frame.

No. 3 frame was a new 50-ton design shown in Fig. 6 which had a lower bar that had a 19¾-in. radius in the bottom part of the frame, this radius being tangent to the diagonal tension part of the bar at the outer point of contact with the column. On top of this bar and under the spring plank was a small malleable iron filler block on which the spring plank rested. As the column bolts passed through the bottom bar at an angle a small V-shaped malleable iron washer was placed between the tie bar and the column bolt nut. The top and bottom arch bars on this side frame were 5 in. by 1¼ in., and the tie bar was ⅝ in. thick.

No. 4 side frame was a 50-ton arch bar frame very similar to No. 3 but as shown in Fig. 7, the radius is only 11 in. at the bottom and the straight portion of the lower arch bar extends to the bottom or inner edge of the column and the bottom of the column is a diagonal straight line instead of a curve as in Fig. 6. It will also be seen that the malleable

iron filler block is somewhat thicker in the 11-in. radius frame.

Frame No. 5, shown in Fig. 8 was a 70-ton arch bar side frame. It also had 11-in. radius at the bottom and a malleable iron filler block. However, in this frame the V-shaped washers are located between the bottom bar and the tie bar and the column bolt nut comes up against the bottom tie bar. The size of bars in this frame is 6½ in. in width and the thickness of the top bar is 1½ in. while the bottom bar is 1¼ in.

Method of Testing

Each bar was laid out at the points of reading on each edge ⅛ in. in from the upper and lower sides of the bar. Some

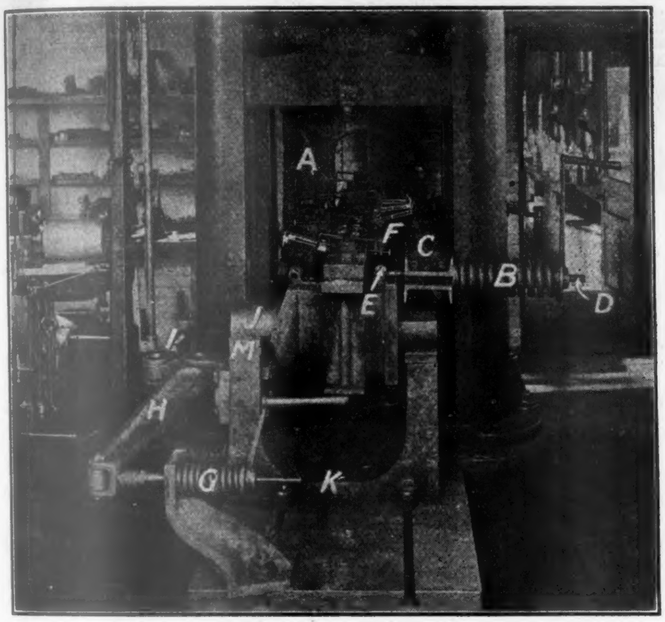


Fig. 2—End View of Truck Frame in Testing Machine

readings were also taken at the tie bar as shown in the figures. Small holes were drilled at each point with a 3/64 in. drill about 1/16 in. deep. These holes were used for placing the points of the Berry strain gage.

The frames were mounted and centered on the testing ma-

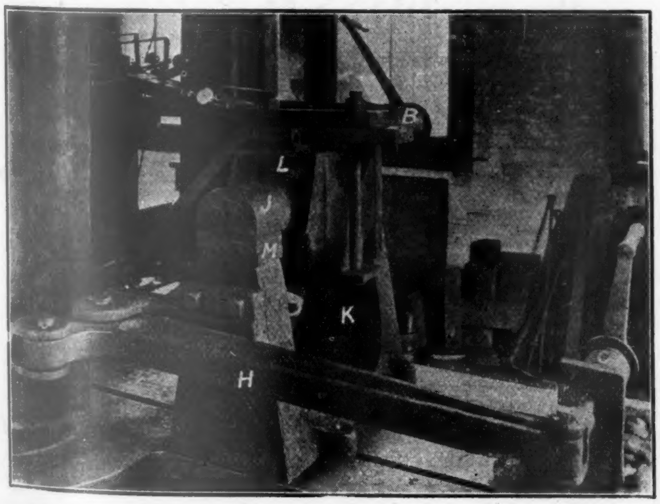


Fig. 3—Side View of End of Frame in Testing Machine

chine as already described and a load of something greater than that for which the test was made was applied to the frame to be sure that all parts were seated after which the load was reduced to 5,000 lb. Several Berry strain gages were clamped at different points on the side frame. The direct vertical load was then increased to 73,500 lb. on the 50-ton frames and on the 70-ton frames 100,000 lb., making an effective load of 68,500 lb. on the 50-ton frames and 95,000 lb. on the 70-ton frames.

The transverse loads of 9,000 lb. and 12,600 lb. on the 50- and 70-ton frames were respectively applied and the Berry strain gage again read after which twisting loads of 6,000 lb. for a 50-ton frame and 8,400 lb. for a 70-ton frame were applied and the fourth reading was taken on the gage. The instruments were then placed at a new position and set to zero with all loads acting. The three loads were then successively removed in a reverse order to which they had been applied, that is the twisting load first, the transverse load second, and finally the direct vertical load. By continuing this method of taking the four readings at each point, the stress equivalent to each of the loads was determined until all points where readings were desired with a 2-in. Berry strain gage on the 50-ton frames, were covered. However, in the test of the 70-ton frame a somewhat more sensitive and accurate gage of the Olsen type was used at the most important points where readings were taken. All frames were tested in identically the same manner as described above.

Results Obtained

Figs. 4, 5, 6, 7 and 8 give the results of maximum stress obtained at any point, the arrow indicating the middle of the point where the gage was seated, the figure representing

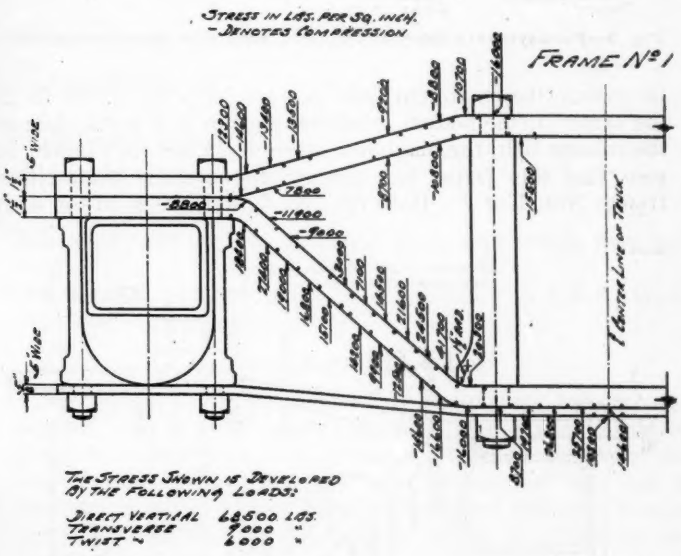


Fig. 4—ARA Standard 50-Ton Arch Bar Side Frame No. 1

either tension or compression at this point. The stress here arrived at was the average of the four identical points on the frame, that is, there were readings taken on both ends of the frame and on both sides of each bar. The stress here given has the sign either tension or compression of the direct vertical load. To this was added the average of the other four readings taken, which were produced by either the twist or transverse load. While the transverse and twist load acted only in the one direction in these tests, it might in actual service act in either direction. This might add to the direct vertical stress if it was either in tension or compression so that the stresses here shown are the average maximum stresses in pounds per square inch that would come at any point on the side frame in service under these loads. Where there is no indication before the number, it is tension, but where there is a minus sign before the number, it indicates compression.

From a survey of these five figures, it will be seen that the ARA standard 50-ton truck has one point at the radius at the bottom which indicated a maximum tension stress of 41,700 lb., and another point at the bottom of the bar between the

column posts of 26,800 lb., while with the Pennsylvania standard 50-ton frame this maximum stress at the inside on the bottom corner was reduced to 36,700 lb. on the top but was increased at the bottom of the frame to 37,200 lb. These stresses, in great measure, show why arch bar trucks in the past have broken near these points. It will be seen in Fig. 6, showing the results obtained on the truck, that with the 19¾-in. radius, the maximum stress on this frame is 25,400 lb. in the center at the bottom, while on the top at a point close to the column bolt, the maximum stress is 24,000 lb. It will be seen that this frame has a much lower stress than either frames Nos. 1 or 2. However, No. 4, which is a 50-ton arch bar frame with 11-in. radius, has a maximum stress of 22,-800 lb. This is at the bottom of the compression member near the column bolts and it has a maximum stress in tension of 19,200 lb., which is at the top of the lower bar at the bottom. All other points on the tension member are less than 19,000 lb.

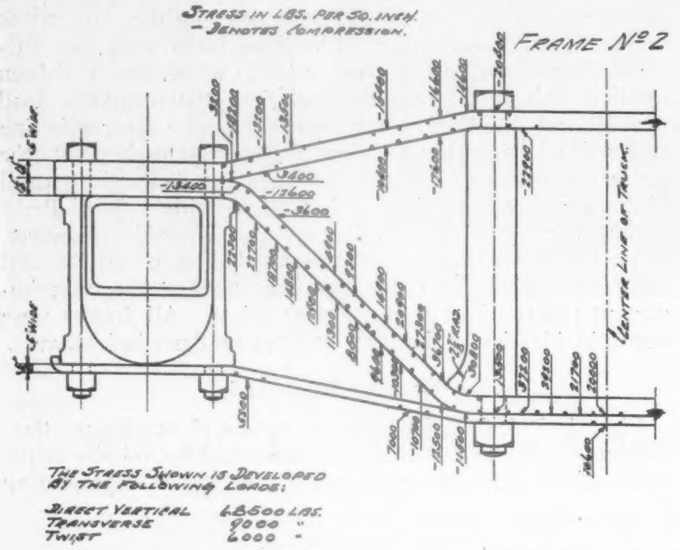


Fig. 5—Pennsylvania Standard 50-Ton Arch Bar Side Frame No. 2

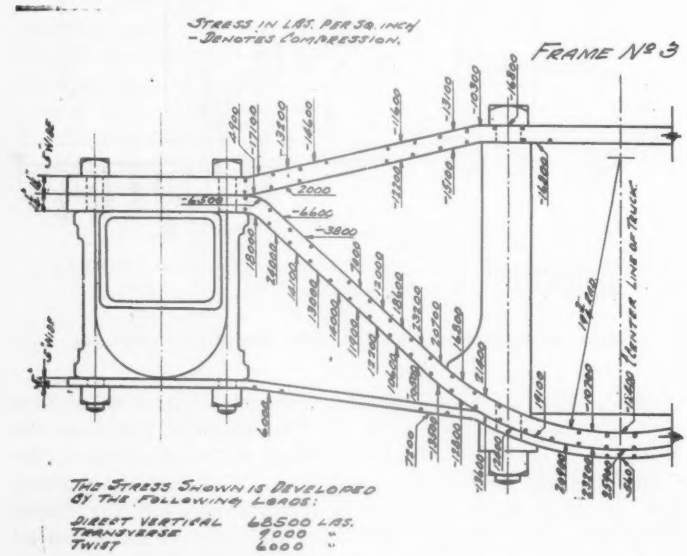


Fig. 6—Experimental 50-Ton Arch Bar Side Frame No. 3

Frame No. 5 which is a 70-ton 11-in. radius bottom bar has a maximum stress in tension of 20,400 lb. and this is at the same upper bend of the lower arch bar as the last frame described. No other point on the frame shows over 20,000 lb. stress. From the results here obtained it is evident that Nos. 4 and 5 frames have a very much lower stress than either one of the first three tested.

While only the results of five frames were given in this report there were in all 12 different designs of frames tested and sometimes two or three of the same design, but the other frames in most cases fell between the maximum and minimum results here given and were not interesting except to the student to cross analyze the results of the different designs of frames. The last two frames given are well within the strength of the metal to last the life of the car.

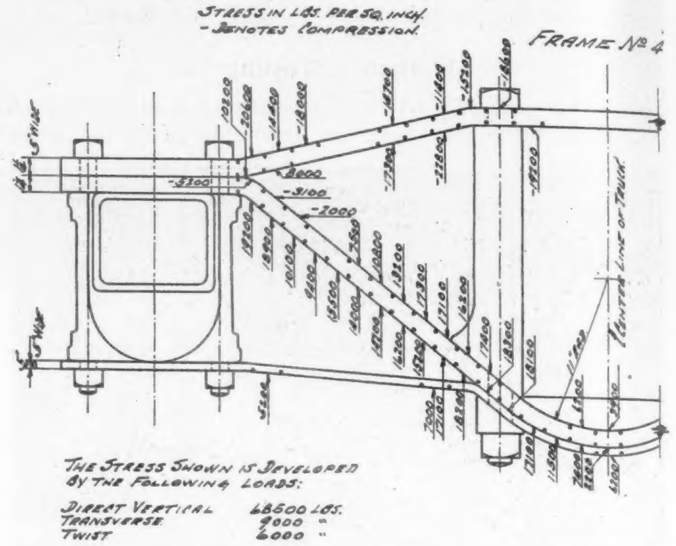


Fig. 7—Improved Arch Bar Side Frame No. 4 for 50-Ton Trucks

Approximately 4,000 cars were built in 1915 and 1916 of a design very similar to that of frame No. 4 of the 50-ton capacity and these frames on these cars are still in service after approximately eight years and from a careful check of all these cars by the officials of the roads having them in use, no arch bar failures or cracked bars have ever been discovered. A photograph of one of these trucks is shown in Fig. 1. There are now being built some cars with the frame No. 5 shown in Fig. 8, and as the stress in the 70-ton frame is no greater than that in the 50-ton frame, which has been in service for eight years, equally satisfactory service without failure doubtless will be obtained from the trucks used under these 70-ton cars.

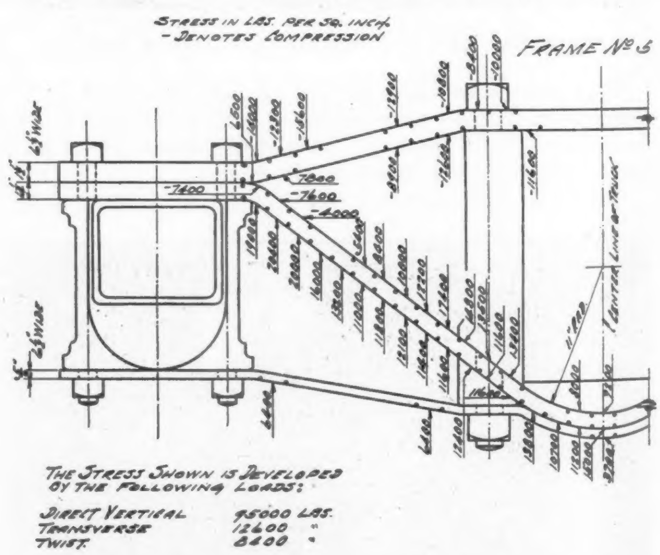
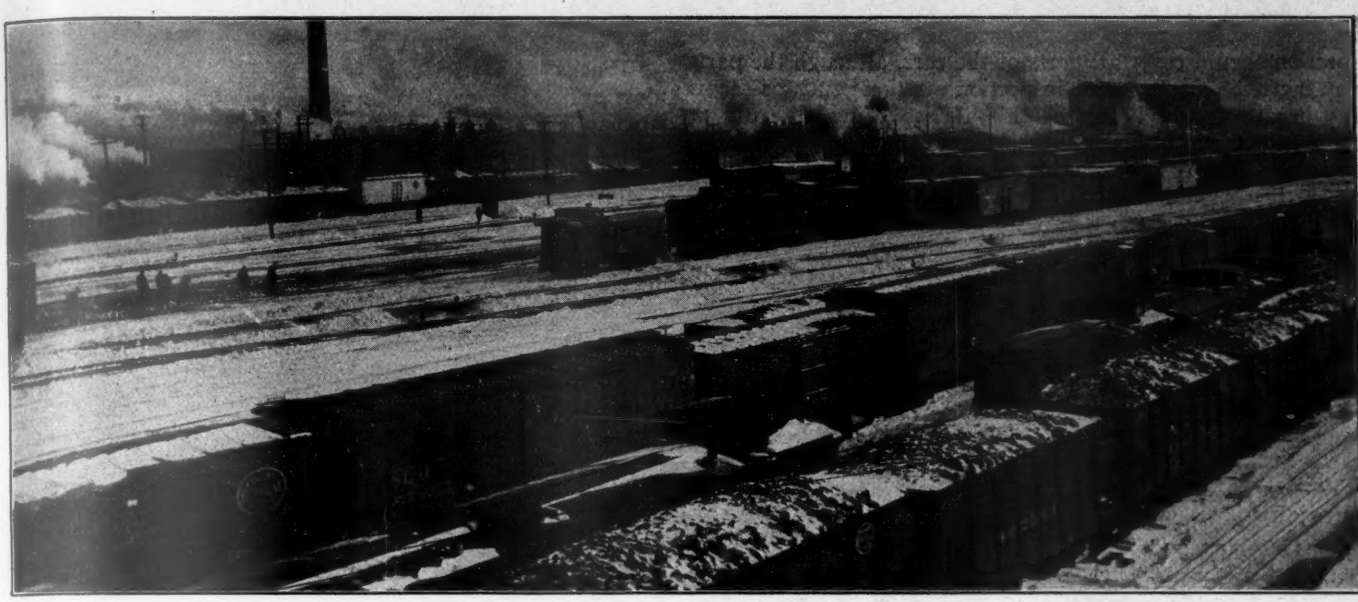


Fig. 8—Improved Arch Bar Side Frame No. 5 for 70-Ton Trucks



Some Good Freight Car Inspection Practices*

Inspector's Work of Vital Importance; Things to Be Remembered and Parts to Be Examined

By D. P. Crillman
General Car Foreman, Michigan Central, Detroit, Mich.

In the first place good judgment must be exercised in selecting car inspectors. A man to be eligible should be not less than 21 years of age, should have had one year or more of experience at car repairing or car building, be able to read and write and pass examination as to eyesight and hearing.

A man working as an inspector in the car department should be not only a car man, but also what is commonly termed a company man. He should have in mind at all times the welfare of his company, as all the railroad has to sell is service and he is just as an essential cog in the wheel as the superintendent. He can help greatly in keeping freight moving across the country by careful inspection of cars for defects which render them unsafe or interfere with their safe movement to destination without accident or being shopped for repair. Inspectors should not shop cars for minor defects where repairs can safely be made in train yards, as this is not only costly but causes delay to freight and makes another dissatisfied shipper.

An inspector should at all times be watchful for defects that may create claims, especially on open top equipment those affecting hopper doors and when lading, such as coal, etc., is found to have been leaking from the car. Have the leakage stopped, also report the car to the yardmaster so that it may be weighed; make a leakage report for same and send a copy of the report to the claim agent. Side doors and side door protections must be given close attention not only on account of loss of freight but also for the safety of passenger trains that they may not be raked by side doors being forced out.

An inspector should become familiar with the clearance of each division of the road on which he is employed. If in doubt as to height and width of a loaded car, measurements must be taken to assure that same are within prescribed published clearance limits of the lines over which they are to pass.

A careful study of and a close adherence to A.R.A. loading rules will prevent accidents.

Interchange Inspection

Where cars are being received in interchange from a connecting line, a close inspection should be made to insure their safe movement and every effort made to move the loaded cars without transfer of contents, as this has a tendency to invite claims, to say nothing of delays to freight and added expense to the railroad which is a loss in net revenue earnings.

Where cars have been received in interchange with delivering company defects that cannot be repaired while the car is under load, but which are safe to run in service, see that all such defects are properly covered by a defect card. Empty cars must be in a serviceable condition to load. The inspector should be familiar with all equipment of the road on which he is employed, watch for wrong repairs which have been made on cars offered home and when wrong repairs are found fill out a joint evidence card covering all such wrong repairs, sending the car to the shop for proper repairs. By so doing he will be helping the upkeep of the equipment and will greatly add to the life of the car. All empty cars should be carefully inspected and classed for commodities in accordance to their conditions. Those found fit for grain or cereal loading should be so carded, although grain cars should not be selected at night. All such cars found in need of repairs should be shopped and repairs made before being placed for loading. This will insure the prompt delivery of lading to destination. Shippers can see no reasonable excuse for placing a defective car for loading.

In freight yards where it is the practice to have two inspectors working together, one on each side of train, one

*Paper submitted in Prize Contest on Car Inspection.

inspector should never work ahead of the other. This inspection should cover all parts of the cars, although the parts requiring the most careful inspection are those such as seams in throat of wheel flange—this defect being difficult at times to discover, loose wheels and broken or chipped flanges. Where inspectors are working opposite to each other they should watch the wheels at the hub on the opposite side from which they are working, as the journal box may hide the loose wheel from the inspector working on same side of the car as the loose wheel. There is a possible chance of a broken flange being hidden from the view of the inspector by a brake shoe, but still in plain view of the inspector working on the opposite side. Close attention must be given to detect cracked wheel plates, especially on refrigerator cars, on account of a crust forming on the metal caused by brine leaking from the car. This is a dangerous defect as refrigerator cars are handled over the lines at a high rate of speed. In many cases such cars are equipped with light capacity wheels which are apt to crack because of brakes sticking and heating the wheel. This is more easily found when the wheel cools off, although the inspector must not depend on the wheel showing signs of heating as cracked plates will be found on wheels with defective material, caused by pressing the wheel on the axle. Sharp flanges should also be gaged to know that they have not worn below the limit of standard gage. If wheel defects are not detected they may cause serious and expensive accidents.

Other important defects to look for are cracked arch bars—which are usually found to crack or to have flaws at bends or column bolt holes of bottom bar—missing or loose nuts such as column or box bolts, carrying iron or brake hanger casting bolt nuts, cotter keys missing from brake rigging and coupler cross keys.

Lubrication and Draft Gear

Lubrication must be maintained to prevent failure in service, thereby avoiding expense and delay of freight on account of setting out cars on the lines for repairs. When making inspection of journal boxes, lids must be lifted—especially those opening with more than ordinary force—even though it be necessary to remove the lid, as these are the boxes that receive little or no attention.

Inspection should cover draft gear attachments, cracked coupler shanks, knuckle pins tested by touching bottom of pin to assure that they are not defective, coupler yokes and yoke rivets, couplers and their parts to insure that they are operative. Couplers must not be less than 31½ in. or more than 34½ in. from top of rail to center line of coupler shank. Inspectors need not bother to lay a board across the rails to measure the coupler height, but can conveniently carry a piece of string long enough to reach across the rails with a small nut tied to each end. By putting this string across the rails, the height of coupler can be ascertained with a 3-ft. rule.

Air Brakes and Safety Appliances

Air brake hose, pipe and other parts must be inspected and maintained. Cylinders, triple valves and retaining valves should be cleaned and tested and so stencilled within nine months of the last cleaning. All out-going trains should have at least 85 per cent of the air brakes operative. Inspectors must know that air hose are properly coupled and angle cock handles are in the proper position, that all leaks have been stopped and that piston travel has been adjusted to from 5½ in. to 6½ in. When adjusting piston travel, live levers should be equally divided on both trucks.

Inspectors must understand that railroads are subject to fines for handling cars with I. C. C. safety appliance defects, this for the protection of trainmen. Therefore, all parts of safety appliances such as hand brakes, hand holds, ladders, sill steps, running boards, uncoupling levers and end clearances must be maintained to proper location and clearance.

Trucks and Brake Beams

Trucks with steel side frames such as Andrews, Bettendorf and others must be inspected carefully to detect cracks or flaws. Side bearing clearance should be watched and, where cars are balanced on center plates, should have 1/16 in. to ⅛ in. clearance between all four side bearings. If a car is found to be bearing hard on one side, the clearance should not be more than ¼ in. on the opposite side.

Rigid inspection must be given to brake beams, brake hangers, brake heads—particularly to eye and key bolts—to see that these parts are not worn to a limit which would make them unsafe.

Sills

Sills, both steel and wood, should be inspected to see that they are not decayed, split, buckled, cracked or spread. This applies especially to draft sills.

No part of the body or truck frame or attachments shall be less than 2½ in. above top of rails. The body of the car should be inspected, including roofs. Roofs found in leaking condition should be shopped for repairs for protection of freight. Close attention should be given to side and end doors. Defective doors should be repaired to prevent swinging out and striking employees or passing trains or falling from the car and causing accidents or possibly loss of freight. Moreover, defective doors or their fixtures encourage pilfering of cars. With a defective door hasp you could not have a clear seal record, thus inviting claims from which your road has no protection.

It is also the duty of inspectors to become familiar with the I. C. C. regulations for the handling of explosives, gasoline, etc. It is important when he finds tank cars leaking to keep open flame lanterns away from such, notify the yardmaster so he in turn can keep all engines at a safe distance until such time as the inspector has made an inspection by the use of an electric flash light and taken every effort to stop the leak. Where a quantity of oil is found on the ground it should be covered with dry earth.

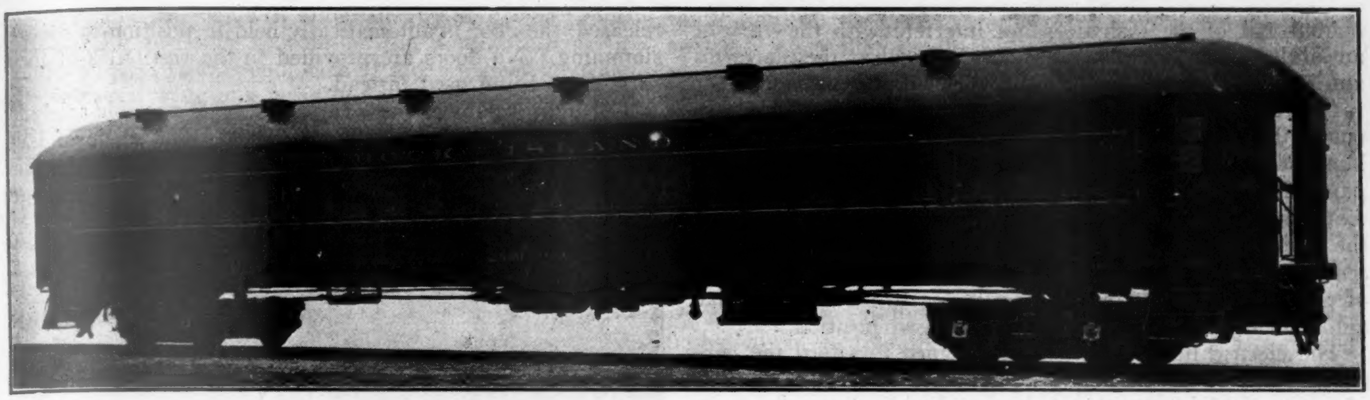
The inspector of today comes under the classification of a carman, also classed as a mechanic; therefore, to meet the qualification of carman the same as must be done in learning any other trade, he should study A. R. A. rules, loading rules, specifications of tank cars and pamphlets that are furnished by the Bureau of Explosives, to be able to pass examination before he can be considered eligible as an inspector. In the larger terminals where a number of inspectors are employed, they can greatly help themselves by holding meetings for the purpose of going over rule books, thus getting a uniform understanding and a proper interpretation of the rules.

As under present rules the inspector's report is of great importance, especially where cars have been damaged under A. R. A. Rule 32. To facilitate the interchange of cars it is necessary to have uniformity of practice in repairing and inspecting and owner's responsibility from that of the handling line; also in making repair bills to give the owner proper information, such as location, reasons, etc., as per A. R. A. rules. Inspectors must furnish correct information as it must not be assumed but must be determined by actual inspection; therefore, inspectors should know the requirements of the rules.

Safety First

Safety should be the first consideration of every railroad employee. One of the most positive and absolute rules is the one that requires car inspectors to protect themselves by a flag or light when working about cars. The necessity and reasonableness of this rule is apparent to everyone.

Safety appliances are all right but what is needed is a safe man to inspect them and see that they are safe. Injure an experienced man and a new man must take his place. A new man is an experiment; therefore, it is an inspector's duty as well as his protection to report unsafe conditions.

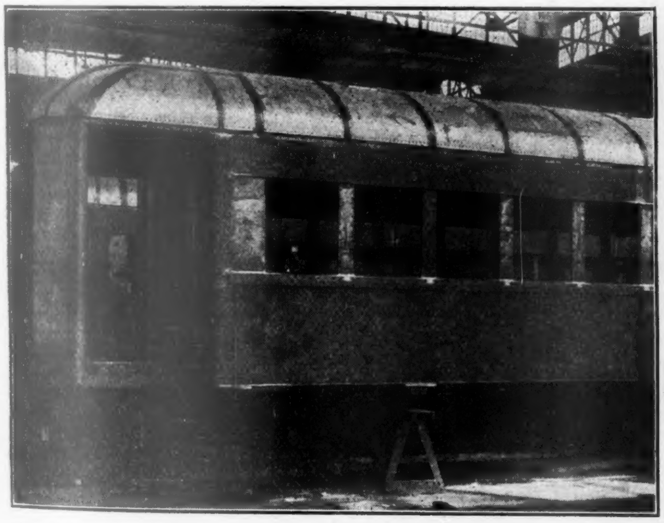


Seventy-Foot Steel Suburban Car Built for the Chicago, Rock Island & Pacific by the Standard Steel Car Company

Suburban Car Featured by Low Unit Weight

New Rock Island Steel Coach Weighs Only 920 Lb. Per Seated Passenger—Special Lighting Equipment

As a part of a program calling for the expenditure of $1,000,000 this year in new equipment, the Chicago, Rock Island & Pacific early in the year placed an order for 50 steel suburban cars with the Standard Steel Car Company. These cars, designed by the Standard Steel Car Company in accordance with specifications prepared by the Chicago, Rock Island & Pacific, are now being delivered and mark an important step forward in the design of this type of car. Without sacrificing strength, the weight of the car has been kept down to 92,100 lb., the body weighing 66,400 lb. and the trucks 25,700 lb. The seating capacity is 100, thus making the weight per seated-passenger approximately 920 lb. These cars are believed to weigh less per seated passenger than any heretofore built.



Erecting Work Completed—Car Ready for Application to Trucks

Particular attention has been given to the comfort and convenience of the passengers as will be seen in many features of the design. The rattan cross-seats, of the Walk-over type, have been made wider than usual in suburban cars and are designed to give maximum comfort to two passengers in each seat. The seat backs are equipped with neat brass handles next to the aisle and 10 hand straps are provided in each end of the car for the convenience of passengers who may be standing in front of the longitudinal seats. The window arrangement has been worked out so as to provide an unobstructed view, and there is a full window to each seat. The window sills are at a convenient height and form comfortable arm rests for passengers sitting next to the windows.

Interior View of the Car Completely Equipped Ready for Service

In order that passengers may be protected from cinders as much as possible, these windows have been arranged so that they can be raised but 10 to 12 in. At the same time, the

bottom rail of the sash does not interfere with the view of an adult passenger. The end doors, as well as the platforms and steps, have been considerably widened over those of other cars of this character so that two lines of passengers can pass out of the doors and down the steps at the same time. End hand rails extend from the door posts to the side of car, parallel to the platforms and slope of the steps. These features, together with the longitudinal seats at each end of the car and the absence of arm rests on the aisle ends of seats, will permit an unusually rapid loading and unloading of passengers. Platforms are provided with safety gates that automatically lock in either open or closed position.

The electric lighting system is designed to afford the best distribution of light that it is possible to obtain, by means of a row of 13 lamps, mounted on each side of the car, each row being located approximately over the center of the cross seats. One lamp is also mounted above each platform step.

The heating system is of the vapor type with double automatic thermostatic control. This control is entirely automatic and does not need the attention of train crews or yard men to operate it. It automatically keeps the temperature

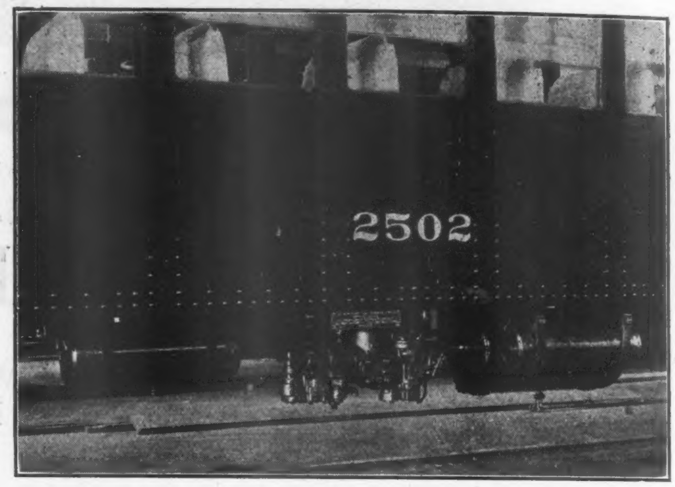
Four-Wheel Truck Equipped with Cast Steel Frame and Clasp Brakes

of the car between 70 and 73 deg. F. while in train service and at 50 deg. F. while standing on steam in the yards.

While it is true that the ratio of live to dead load has been given little consideration in passenger service, these cars represent decided progress towards establishing a desirable relation from the operating viewpoint. The light weight plus the use of clasp brakes and arrangements for rapid load-

released, the door is automatically held in position to prevent slamming. No doors are provided in the vestibules of these cars, gates being used instead.

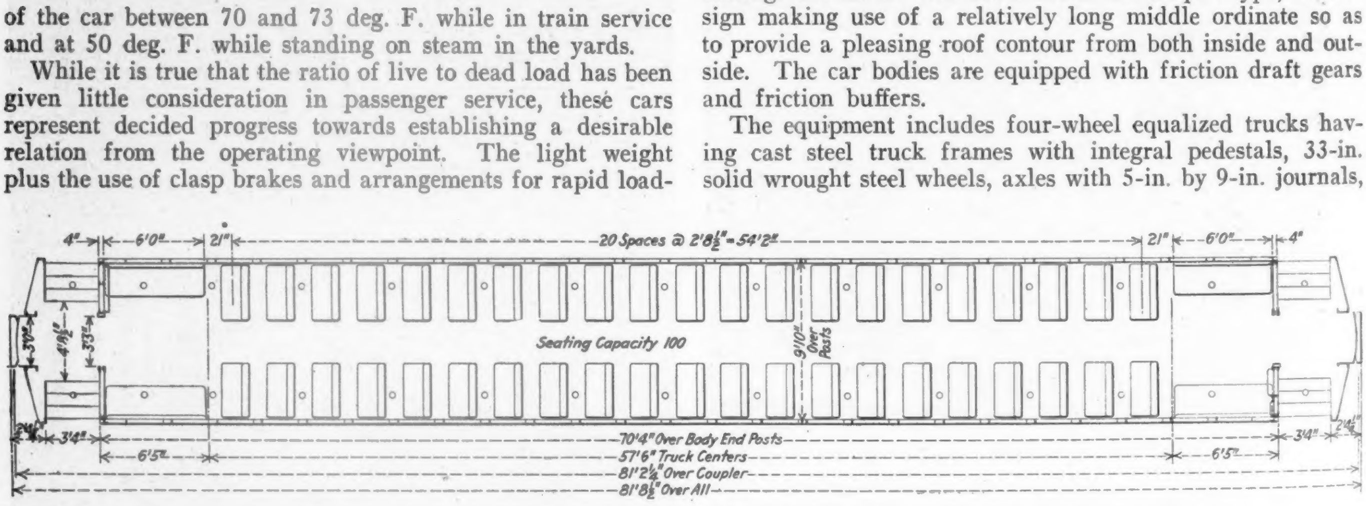
The light weight of these cars was made possible solely by careful analysis and calculation, no use being made of light weight non-ferrous metals. With the exception of the zinc bottom floor sheet and galvanized roof sheets the cars are constructed throughout of copper bearing steel insofar as all



Application of Westinghouse Type U. C. Brake Equipment

sheets, plates and structural members are concerned. The side girder type of construction is used with the sides from belt rails to side sills designed to carry the vertical loads. Vertical loads imposed upon the floating center sills are transmitted to the side girders by three substantial cross-bearers. Cast steel combined body bolsters and platform castings are used. The roofs are of the elliptic type, the design making use of a relatively long middle ordinate so as to provide a pleasing roof contour from both inside and outside. The car bodies are equipped with friction draft gears and friction buffers.

The equipment includes four-wheel equalized trucks having cast steel truck frames with integral pedestals, 33-in. solid wrought steel wheels, axles with 5-in. by 9-in. journals,



General Arrangement of New Rock Island Steel Suburban Cars Built by the Standard Steel Car Company

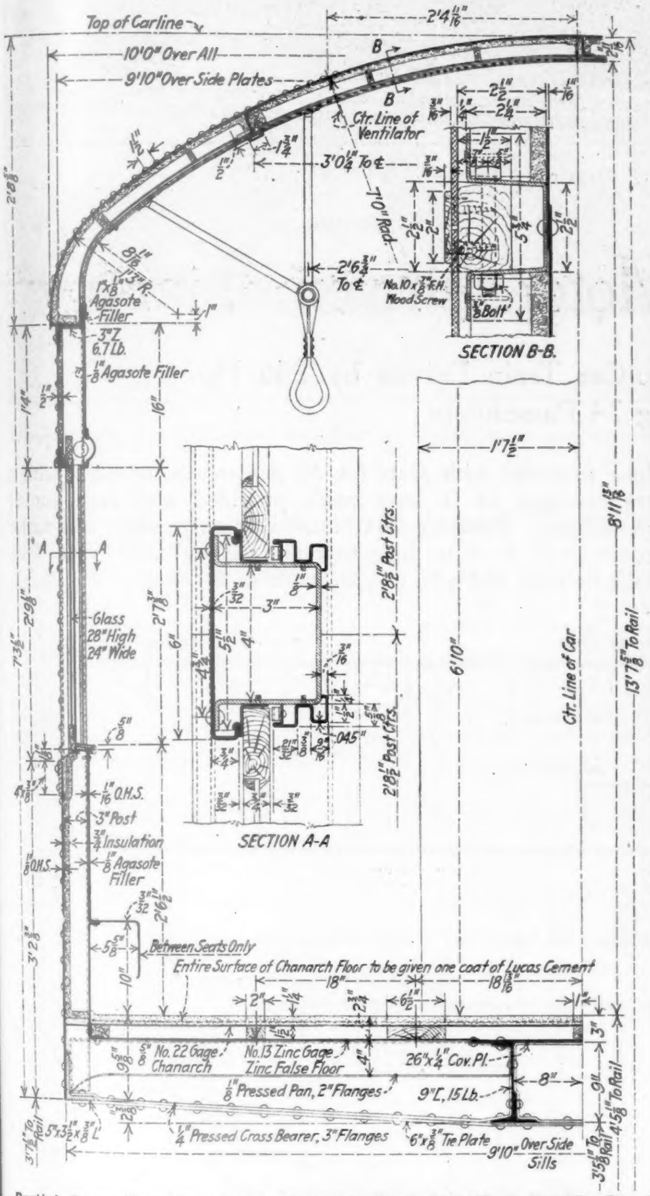
ing and unloading will permit of decreases in the time increments required for acceleration, deceleration and station stops.

The length of the car over the body end posts is 70 ft. 4 in. and the width over the roof sheets, 10 ft. 0⅛ in. The total height above the rail is 13 ft. 7¾ in. There are 42 cross seats each seating two persons and four longitudinal seats, each seating four persons. The ease of entrance and exit are readily apparent from the drawing which shows the end doors to be 3 ft. 3 in. wide and the steps 3 ft. 4 in. wide. The two end doors are of the sliding type with latches similar to those used on subway cars. The doors can be readily moved by a pull on the handle, but as soon as the handle is

roller side bearings and clasp brakes. The wheelbase of the trucks is 6 ft. 4 in. and the distance between truck centers is 57 ft. 6 in.

The electric lighting equipment is of interest because of the provision made to prevent a complete light failure at any time, and also because of the provision made to enable the use of either 64 or 32-volt current supply. The Rock Island standard car lighting service utilizes a 7½-kilowatt 64-volt turbo-generator with the necessary control devices placed on the suburban locomotives, using three-wire train lines for distribution to the cars. However, it is occasionally desirable to attach a suburban car to the rear of a regular main line train, at which time the lighting equipment of the car must be

so designed that the car will automatically make the proper connections for utilizing 32 volts on the lighting circuit instead of 64 volts. To this end, each of the new steel suburban cars is equipped with an especially designed automatic selector switch. This switch automatically causes the proper voltage to be impressed upon the lamps, regardless of whether



Partial Cross Section of the Chicago, Rock Island & Pacific Steel Suburban Car

the current supply to the car through its train line connector is 64 or 32 volts. This switch operates in conjunction with a manually controlled switch which is the only part of the entire equipment that is accessible to the trainmen. This is a four-position switch with the lever operating in one direction from the first step, which is the off position. The second step is the full-on position, the third step is the first emergency position and the fourth step is the second emergency position. This switch is plainly stenciled to insure proper operation by the trainmen.

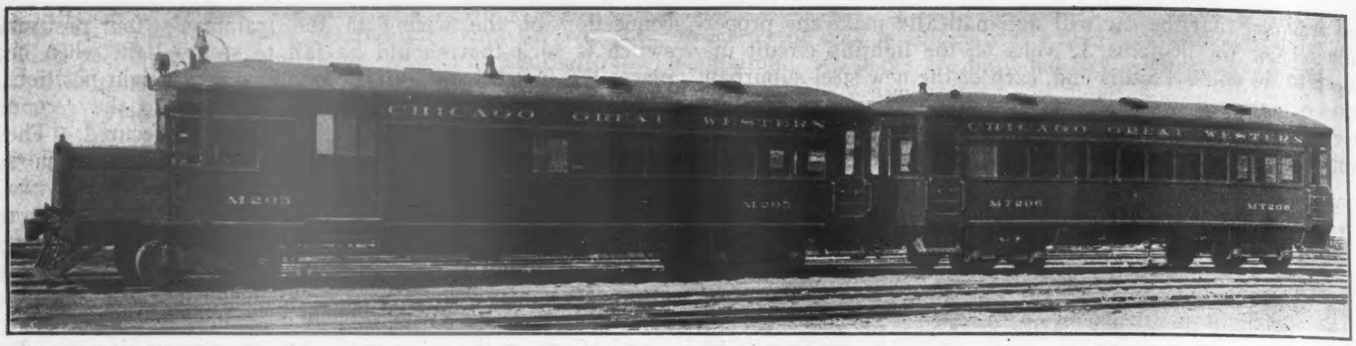
Each car is equipped with a 32-volt, 80-ampere-hour emergency storage battery floated on the train lines through a resistor. This battery is so connected that in case of failure of the current supply from the engine, its current is automatically made available for the lamp circuits, it only being necessary for the trainmen to throw the four-position trainmen's switch into one of the two emergency positions. The connection of the wiring to the trainmen's four-position switch is such that should he fail to secure light when he places the switch handle in the first emergency light position, he has only to push it on a little further to the second emergency light position when light will be secured. The lamps are so connected in series parallel in alternate pairs that when the four-position switch is in either of the two emergency positions that only one-half of all the lamps in the car are lighted. An even distribution of the lighting, however, is maintained due to the method of wiring and location. This emergency lighting arrangement affords ample lighting for the car by having all the lamps in the car connected to one or the other of the two emergency circuits. It is always possible in case of failure of one circuit to still

Interior View, After Assembly of Underframes, Sides and Roof

supply ample light to the car with the other circuit and at the same time maintain an even distribution of the light.

Inasmuch as the battery with which these cars are equipped is used primarily to control the heating system, and only serves in an emergency for lighting, a small size, lightweight battery is used. The heating equipment includes an air operated switch that disconnects the lighting circuit from the battery, when there is no air on the car, so that the battery cannot be bled when cars are standing in yards.

THE AMERICAN ENGINEERING STANDARDS COMMITTEE have recently approved as tentative American standards, a number of methods for the routine analysis of paint pigments, yellow, orange, red and brown pigments containing iron and manganese and of dry red lead as a basis for analysis, and in order to eliminate as far as possible the many controversies now existing. The specifications for these methods of analysis were presented for the approval of the American Engineering Standards Committee by the American Society for Testing Materials under whose auspices the specifications were developed. The specifications in more detail include methods of determining specific gravity, tinting strength of the colored pigments, moisture, and detailed methods for various chemical determinations.



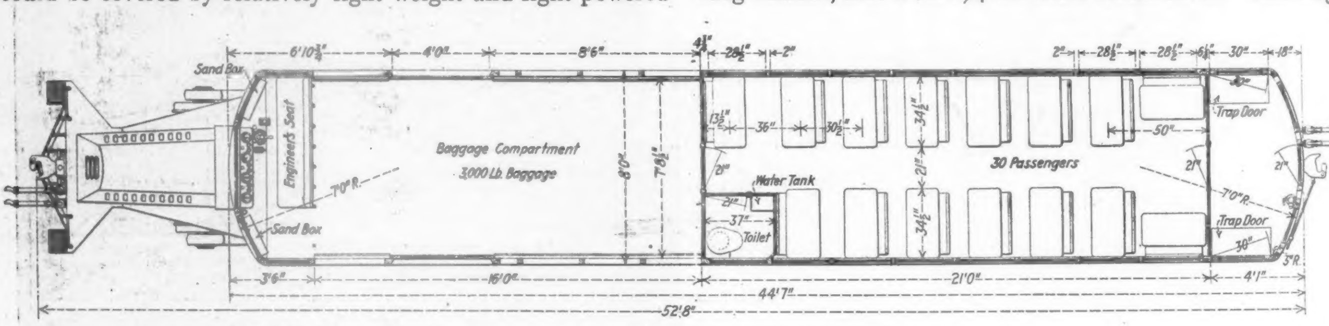
Sykes Motor and Trailer Car Seats 74 Passengers and Carries 3,000 Pounds of Baggage

Powerful Gasoline Motor Driven Train

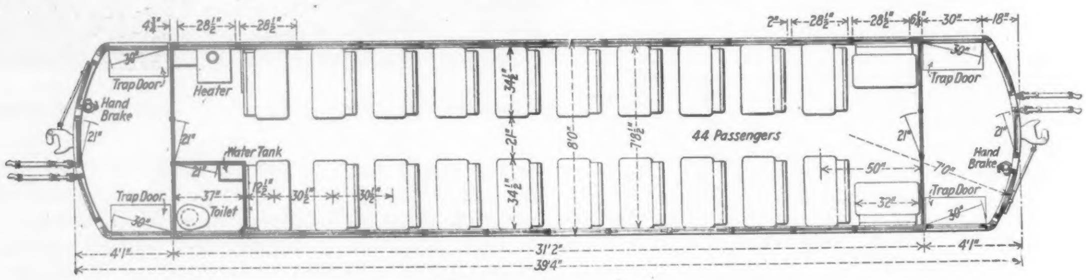
Sykes Company Demonstrates Two-Car Train Driven by 245 Hp. Engine and Seating 74 Passengers

THE heavy-duty gasoline motor driven coach, capable of hauling one or more trailers, presents a problem far more difficult of solution than that which the smaller equipment has had to meet. In the field which could be covered by relatively light weight and light powered equipment a number of designs are available at the present time, several of which have demonstrated their ability to do the work required in regular service. There exists, however, in the minds of many railroad men a feeling that there is a need and a real field for larger and more powerful motor car units. In response to this expressed desire several designs have already been offered but owing to a lack of driving power, some weakness in transmission or gearing, cars too weak for the hard duties of railroad service, high operating and maintenance costs, or to some feature not yet perfected the evolution of such equipment has been a slow one. For these reasons the new equipment which has been built by The Sykes Company, Winthrop Harbor, Ill., is of special interest.

The first train, which has been delivered to the Chicago Great Western, consists of a motor coach having a baggage compartment 16 ft. long and a passenger compartment 21 ft. long provided with seats for 30 passengers, together with a trailer coach 33 ft. long inside provided with seats for 44 passengers. Both cars have toilet compartments. The motor coach is 51 ft. 7 in. long over-all, with a body 44 ft. 7 in. long outside, and 8 ft. 3¼ in. wide at the eaves. The height over-all is 12 ft. 2½ in. The trailer coach is 39 ft. 4 in. long over-all and 31 ft. 2 in., long inside the passenger compartment. The inside width of both cars is 7 ft. 9½ in., the height from floor to ceiling is 8 ft. and the elevation of the floor above the top of the rails is 3 ft. 7 in. The distance between truck centers is 33 ft. 7½ in. on the motor car and 23 ft. on the trailer. The wheelbase of the trucks is 5 ft. 2 in. and the cars are adapted to pass around curves of 100 ft. radius.



Floor Plan of Motor Coach Showing Baggage and Passenger Compartments



The Trailer Coach Seats 44 Passengers

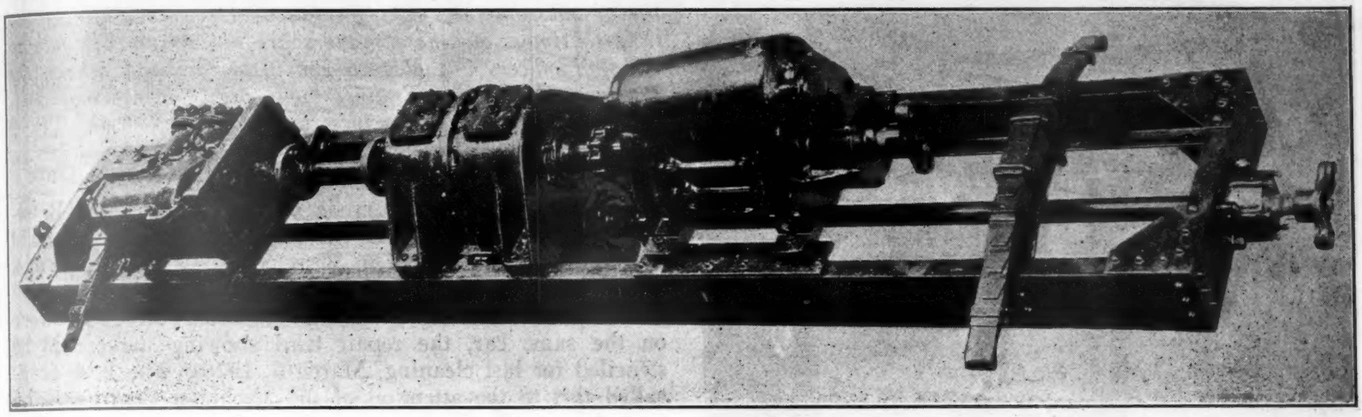
The light weight of the motor coach is approximately 38,000 lb. and of the trailer coach 26,000 lb. As the train provides seats for 74 passengers this is at the rate of 865 lb. dead weight per passenger seat. In addition, the 16-ft. baggage compartment has a normal capacity for 3,000 lb. of baggage.

The cars are driven by a Sterling six-cylinder gasoline

motor with cylinders, 5¾ in. bore by 6¾ in. stroke, developing 180 hp. at 1,250 r.p.m. and 245 hp. at 1,750 r.p.m. Electric starting and lighting systems are provided, the motor being direct driven from the engine and of a capacity sufficient to carry all the lights of a two-car train, including the headlight, and to keep the lighting batteries charged to capacity at all times.

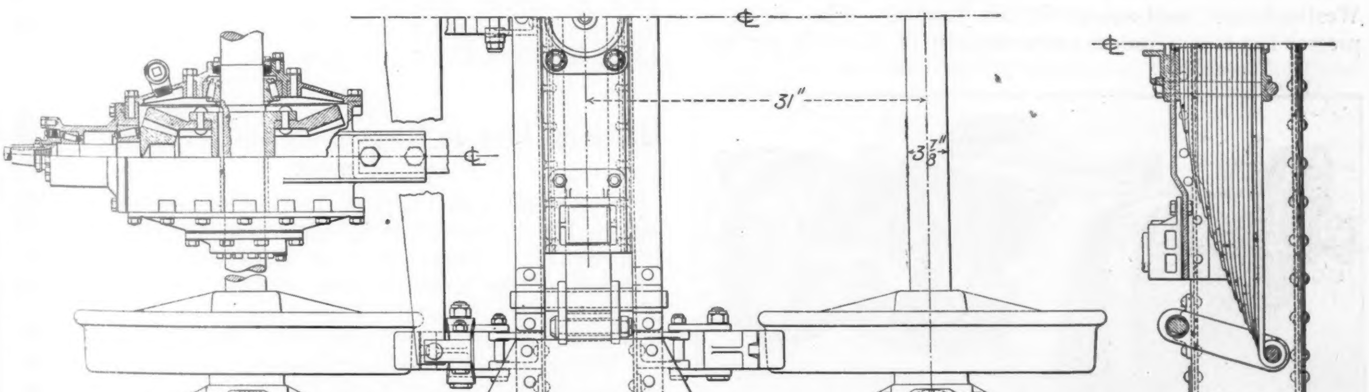
The clutch is of the Hale-Shaw type, of high capacity and runs in oil. It was developed for ordnance work by the U. S. army and also was used for submarine chasers. The transmission is of a special jaw-clutch type built by the Cotta Transmission Corporation and direct connected to a transfer gear case. The speeds provided for are 8.9, 15.1, 28.7 and 43 m.p.h. ahead and 6 and 15 m.p.h. in reverse. The drive is connected by bevel gears to the inside axle of each truck.

An interesting and important feature of the design of this car is the use of a sub-frame suspended by springs from the main channels of the motor coach. The transmission, transfer gear box and air compressor are mounted on this sub-frame. This method of suspension eliminates gear noises and vibrations. Moreover the entire driving mechanism may be dismounted and another set mounted to replace it in two hours' time. The motor and entire power plant are so fitted that they can be detached, removed and replaced in the space of an hour. By carrying spare units and replacing when repairs are required, the work can be performed economically and the car kept in service while the driving mechanism is being overhauled. These points are typical of the attention that has been given to the details of design which should tend to keep the costs of maintenance at a minimum.



Transmission, Transfer Gear Box and Air Compressor are Mounted on a Sub-frame Which Is Spring Suspended from the Main Frame of the Coach

The front and rear trucks are of standard bolster construction with semi-elliptic springs under the bolster and



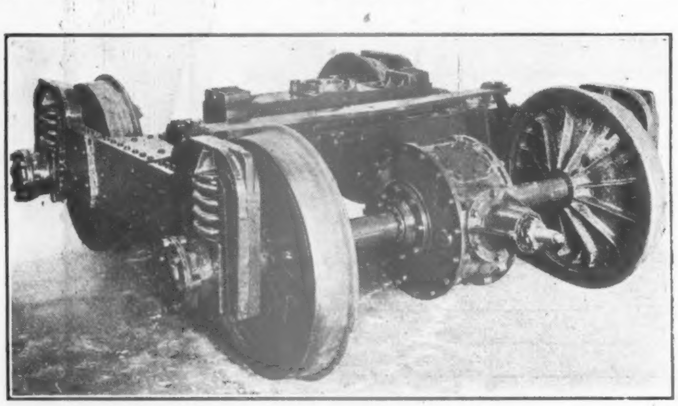
Plan and Elevation of Truck Used on Sykes Motor Car

with swinging suspension cradles. The wheelbase is 5 ft 2 in. and the wheels 30 in. in diameter with cast steel centers and rolled steel tires. The axles are of chrome-nickel steel,

Driving Compartment of the Motor Car

heat treated, 3⅞ in. in diameter and have 3½ in. journals with Stafford roller bearings.

In addition to hand brakes the cars are equipped with Westinghouse semi-automatic air brakes. The air compressor has two cylinders and a capacity of 10 cu. ft. per min.



Motor Car Truck with Axle Drive

There are two main reservoirs, 18 in. by 72 in. The foundation brake rigging includes brake shoes of the type commonly used in railroad service. The cars are equipped with M.C.B. automatic couplers, cored out to save weight, and located at the standard height above the rails.

In the preliminary runs on the Chicago Great Western the train, about two-thirds loaded, attained a speed of 63 m.p.h. on the level and was driven over a one per cent grade, seven miles long, the summit being passed at a speed of 47.4 m.p.h. with the throttle three-quarters open. The throttle was never fully opened during the run yet there was at all times an apparent surplus of power.

Recent Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Another Case of Failure to Stencil Cleaning Date

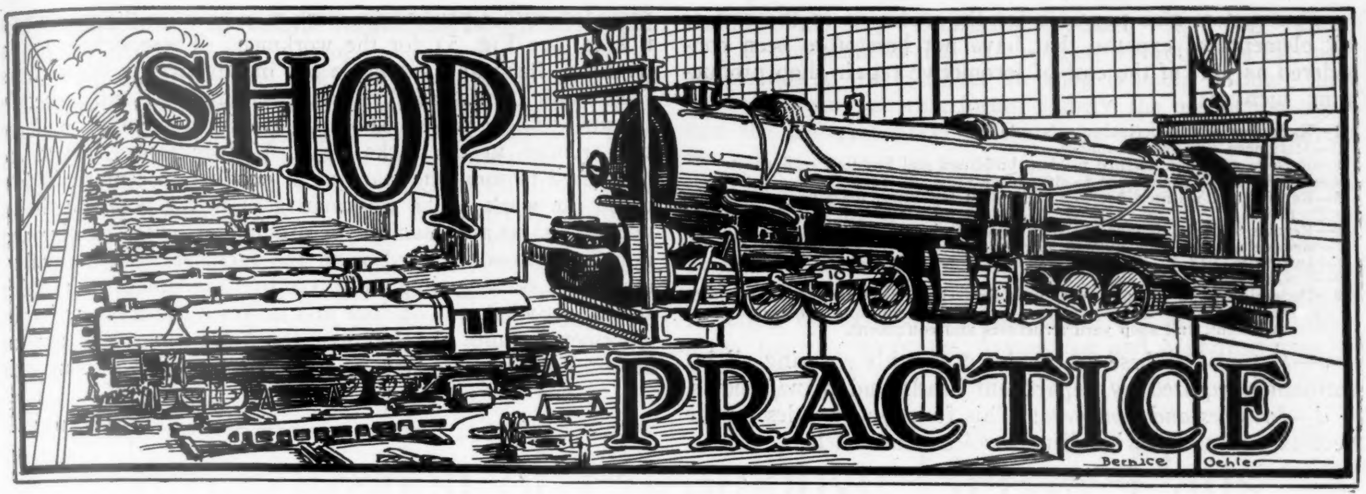
The Michigan Central made a charge against the Bessemer & Lake Erie of $4.92 for cleaning, oiling, testing and stenciling the air brakes on Bessemer & Lake Erie car No. 8534, on December 13, 1920. On February 23, 1921, the Buffalo, Rochester & Pittsburgh reported the same work on the same car, the repair card showing the car to be stenciled for last cleaning, March 6, 1920. The B. & L. E. called this to the attention of the Michigan Central asking for offset authority or correction of car number. The Michigan Central claimed the initial and number to be correctly reported and refused offset authority on the ground that the car was on the Michigan Central line on March 6, 1920, and that it did not have the air brakes cleaned at that time. The Michigan Central stated that: "Had Buffalo, Rochester & Pittsburgh shown last date of brake cleaning the same as reported by our man, we would gladly concede the point that it was negligence on the part of our repair man." The car owner maintained that when received home January 17, 1921, no interchange inspector could know that the Michigan Central would later make a bill for stenciling the car, because the charge had not yet been made.

The Arbitration Committee's decision states that: "It is evident that the Michigan Central failed to apply proper stenciling or obliterate old stenciling at the time the work was done. Its charge, therefore, should be withdrawn. Rule 90 applies, and car owner could not be expected to obtain joint evidence upon arrival of car home."—*Case No. 1252, Michigan Central vs. Bessemer & Lake Erie.*

Handling Line Is Responsible for Damage in Derailment

On November 3, 1920, St. L. B. & M. flat car No. 8668 was broken in two while in the possession of the Macon & Birmingham. Under date of November 4 the car accountant of the handling line advised the car accountant of the owning line (the Gulf Coast Line), that the car was destroyed in a derailment. On November 4, December 13, December 27, 1920, and January 5, 1921, the superintendent of the Macon & Birmingham reported to the mechanical superintendent of the owning line that the car had been in an accident and asked for depreciated value in order that he might determine whether it would be cheaper to destroy or rebuild the car. Later, however, after an inspection of the car, the mechanical department of the Macon & Birmingham decided that the car was broken in two in ordinary switching and on April 18, 1921, the owner was so advised, a sworn statement to the effect that the car was "derailed and damaged in ordinary switching," from the conductor in charge at the time the car was damaged being attached as evidence. On this basis the handling line claimed owner's responsibility.

The Arbitration Committee decided that: "In view of the statement of the conductor handling the train that the car was derailed, as noted in the agreed statement of facts, the handling line is responsible."—*Case No. 1255, Gulf Coast Line vs. Macon & Birmingham.*



Locomotive Scheduling at the Silvis Shops

Part 3—Analysis of Cost Accounting Division

New Schedule System to Provide Centralized Control of Production and Accurate Cost Data

By L. C. Bowes,* G. F. Sandstrom,† and H. K. Robinson ‡

THE previous articles have dealt primarily with the procedure of controlling production activities, making for efficient and economical output. However, in order to reflect such economical output, it is very essential that there be a supporting division of cost accounting. But, such accounting procedure should not be based on accounting requirements alone as heretofore, which is all very well in itself, but should be designed absolutely on engineering procedure and data, which can only be secured by the aforementioned well defined and established centralized control of all production activities. In other words, the accounting division should reflect and be governed by the production activities rather than the production activities be governed by the procedure laid down by the accounting division. There would then be an organized endeavor which would make available real analysis and subsequent control, creating an opening whereby the potentialities of production can be clearly established, rather than having a mass of statistical and post mortem data. It is very evident, therefore, that because of the fact that production functions and routine are based on unit operations and analysis, the desired accounting procedure must also be based on unit classification, which means nothing more nor less than to satisfy the great cry of the present age for

Unit Costs

A true system of unit cost accounting makes possible the establishment of predetermined performance, which in comparison with actual performance makes obvious the potentialities of such a system.

Functions of Cost Accounting Division

The proposed system provides for the following functions, which will be supported by necessary routine.

1—General Accounting
a—Shop ledger
b—Expense ledger
c—Reports
d—Invoices and vouchers

2—Cost Accounting
a—Detail costs
b—Comparative costs
c—Expense analysis
d—Labor and material distributions
e—Expense distribution

3—Payroll
a—Timekeeping
b—Payroll summaries

4—Statistics

Following is a detailed explanation of the foregoing listed functions:

1—General Accounting

a—Shop Ledger: The system provides for using a shop ledger for controlling all the charges and disbursements that the particular shop is responsible for. This shop ledger is also used for controlling the expense accounts that appear in the expense ledger, the expense ledger being divided departmentally and the expense analysis being maintained according to as few accounts, or as many accounts as may be found desirable. The chart of accounts is so designed that it permits of the maximum amount of elasticity, in the arrangement and grouping of accounts.

b—Expense Ledger: This is used for providing departmental analysis of all expenses. This ledger is so arranged that a budgetary control may be used in connection therewith for each and every account.

At the close of each month, detailed comparative expense analyses are compiled from this expense ledger for the departmental heads so that they may be informed as to the expense of operating their respective departments and do all in their power to control these expenses. A few of the important expense accounts that heretofore have been buried in the cost of shop operation, which are brought out in this proposed system of cost accounting, are as follows:

1—Losses, due to lack of material.
2—Losses, due to insufficient appropriation of working capital.
3—Losses, due to idle equipment.
4—Work on defective purchased material.
5—Defective purchased material, not replaced by vendor.
6—Defective workmanship (errors in processing).
7—Defective design.
8—Transferring parts from one locomotive to another due to lack of material.

*Production engineer, C. R. I. & P.
†Industrial engineer, Roberts-Pettijohn-Wood Corporation.
‡Special accountant, C. R. I. & P.

This system also provides for the inclusion in the cost of all elements of expense that have not heretofore been considered as part of the cost of locomotive repair shop production, such as:

1—Executive and superintendent's salaries.
2—Stationery and office supplies.
3—Repairs and maintenance to shop buildings and building equipment.
4—Repairs and maintenance to shop machinery and equipment.
5—Repairs and maintenance to power plant buildings, machinery and equipment.
6—Repairs and maintenance to shop yards and equipment.
7—Service charges from outside departments.
8—Insurance.
9—Taxes.
10—Depreciation on all property, including shop buildings and equipment, shop machinery and equipment, power plant buildings, machinery and equipment, and shop yard structures and equipment.

c—Reports: These are rendered monthly covering all information required by department heads and managements.

d—Invoices and Vouchers: This function provides for the necessary routine for handling invoices and vouchers.

2—Cost Accounting

a—Detail Costs: The departmental cost method is the one proposed, which reflects the detailed costs as of the departmental grouping in the shop. In addition to departmental analysis and consequent cost, the system is capable of obtaining unit operation costs departmentally. The cost of locomotive repairs will be recorded in regular accounting procedure according to the specific divisions of classes of repairs on each locomotive. It is the intention to separate definitely the costs of actual repairs to locomotive parts as against the cost of manufacturing new.

b—Comparative Costs: The comparative cost record is used for making final analysis of costs. The costs will be recorded according to individual parts, and classes and divisions of locomotive power. All comparisons of costs will be reduced to a per unit basis.

c—Expense Analysis: Detailed departmental comparative expense analysis, will be provided that will reflect a comparison of actual expenses for each and every account by departments, with the average actual "to date" and the average or budget amount for any preceding period. In addition, a further comparison will be made of the total actual expenses "to date" with the total predetermined or budget "to date."

d—Labor and Material Distributions: Labor distribution will be made according to direct and indirect labor; direct labor being that which can be charged to a specific order for locomotive repairs or stock orders for manufacture of repair parts. Indirect labor being all other than that not mentioned above.

Material distributions will be maintained according to direct and indirect materials, the same as labor distribution.

e—Expense Distribution will be maintained so that detailed analysis may be had of any statistics that may be required, such as the repair and maintenance to individual machines or groups of equipment.

3—Payrolls

a—Timekeeping: The timekeeping system provides for the use of an individual job ticket, which means one ticket per man, per operation, per day, and covers all information necessary for the detail unit labor costs.

b—Payroll Summaries: This provides for the necessary gathering of payroll and labor statistical data.

4—Statistics

This provides for the necessary compilation of any statistics required by shop, management or other governing bodies.

Routine of Accounting Division

At this time only the routine of such established functions as are actually in operation will be explained in the following:

The booths illustrated in the July issue of the *Railway Mechanical Engineer*, Fig. 3, were placed and each booth provided with a production clerk who handles the production tickets (see Fig. 5) for the workmen. These tickets are in triplicate form and are made out in advance by these clerks from data furnished by inspection reports and schedule boards. These tickets show the work to be done and are then placed in the racks (Fig. 4, July issue) which are numbered to show the machine or production center which is to do the work. The workman goes to his booth, calls his number, name and machine or production center number and the clerk takes the card from the rack, shows his number, name and starting time and gives him the ticket. The ticket shows just what is to be done and makes it unnecessary for the workmen to hunt the foreman for instructions. If a print or drawing is necessary, it is given to the workman with

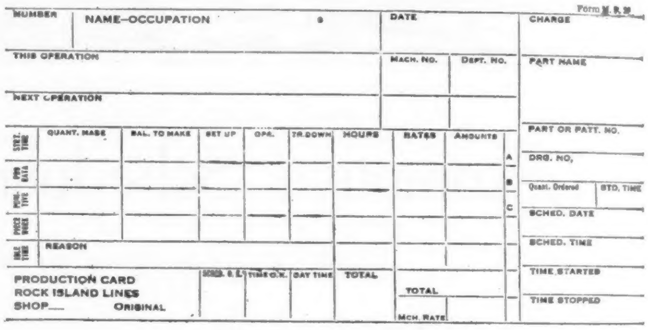

Form M. R. 20
NUMBER
NAME—OCCUPATION
DATE
CHARGE
THIS OPERATION
MACH. NO.
DEPT. NO.
PART NAME
NEXT OPERATION
QUANT. MADE
BAL. TO MAKE
SET UP
OPS.
TR. DOWN
HOURS
RATES
AMOUNTS
PART OR PATT. NO.
A
DRG. NO.
B
Quant. Ordered
STD. TIME
C
SCHED. DATE
REASON
SCHED. TIME
PRODUCTION CARD
ROCK ISLAND LINES
SHOP___ ORIGINAL
TIME O.K.
DAY TIME
TOTAL
TOTAL
MCH. RATE
TIME STARTED
TIME STOPPED

Fig. 5—Production Card

the production ticket. After the job is finished the workman returns the ticket to the booth, the production clerk shows time finished and gives him the ticket for his next job. At the end of the day the total time shown on the production tickets for the day is checked against the total time shown on the "in and out clock card." This card shows only the man's number, name, occupation and the clock stampings. The production tickets for the day then go to the office of the Production Department, the triplicate is detached for use of the production supervisor and the time study men, the original and duplicate being forwarded to the Accounting Department. Comptometer operators then multiply the hours on each ticket by the man's rate and show the amount to be paid for that particular job, after which

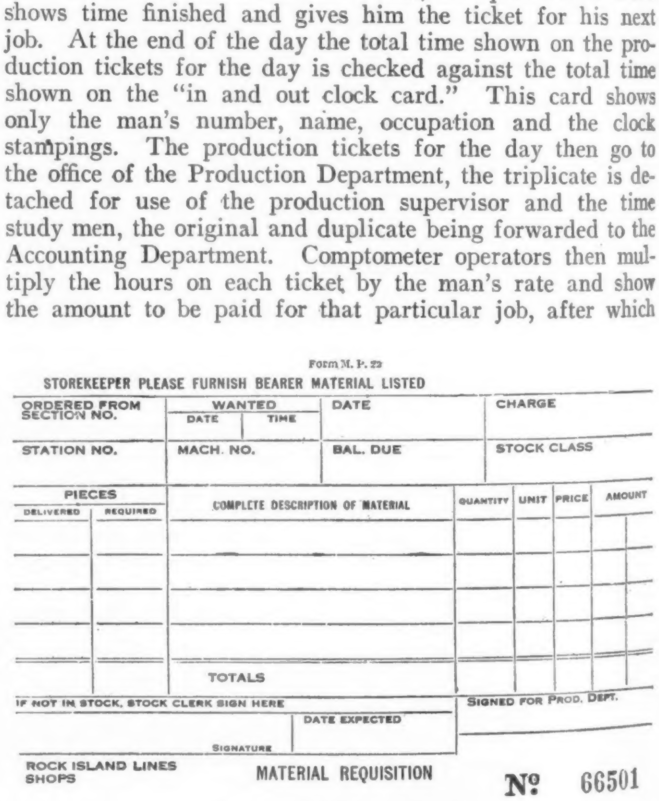

Form M. P. 22
STOREKEEPER PLEASE FURNISH BEARER MATERIAL LISTED
ORDERED FROM SECTION NO.
WANTED
DATE
TIME
DATE
CHARGE
STATION NO.
MACH. NO.
BAL. DUE
STOCK CLASS
PIECES
DELIVERED
REQUIRED
COMPLETE DESCRIPTION OF MATERIAL
QUANTITY
UNIT
PRICE
AMOUNT
TOTALS
IF NOT IN STOCK, STOCK CLERK SIGN HERE
SIGNATURE
DATE EXPECTED
SIGNED FOR PROD. DEPT.
ROCK ISLAND LINES SHOPS
MATERIAL REQUISITION
№ 66501

Fig. 6—Material Requisition

the duplicate is detached and turned over to the cost department, the original going to the payroll department from which payrolls are made after the comptometer operators have made a consolidation of each man's time and money for the day period.

All statistics heretofore required can be compiled from these tickets, which in no way interferes with reports and

statements required by federal regulations or operating and accounting officers of the railroad.

The cost department is furnished the duplicate copies of the production tickets as soon as the earnings are shown and assorts these tickets by accounts, locomotive numbers, jobs, etc., after which it is just a matter of consolidation.

Material tickets (see Fig. 6) for material used in the shops are prepared in triplicate and when the material is drawn the triplicate is returned to the Production Department, the original and duplicate going to the store accounting office where they are priced and extended into money, the originals supporting the store bill versus the shop and the duplicate remaining in the store office for record. The cost department then assorts the original and handles them in the same manner as the production tickets for the labor.

It is important to note that a great advantage of this new system lies in the fact that the shop is using no more than the two already existing forms, namely, the production ticket and the material ticket, which however, have been merely revised.

[The next and last article will take up the matter of Performance. This will be strictly an engineering dissertation. setting forth certain well defined principles and attempt to show the potentialities of a possible output of 180 locomotives per month, by exploiting the practicability of the theory of breaking up locomotive repair work into three major divisions, namely, Stripping, Assembling and Manufacturing.—EDITOR.]

Standardization of Locomotive Repair Parts*

Part 3

Methods of Manufacturing and Fitting Standard Taper Frame Bolts; Reaming Holes to Step Gages

By M. H. Williams

It is not difficult to set sizes suitable for taper frame bolts, and where once properly established it will be found that a reduction in cost and time of turning will follow.

For tapers of 1/16 in. per ft.—mostly used for frame bolts —the diameters or step sizes can, to good advantage, advance by either 1/64-in. steps which is equal to the increase in diameter of 3 in. length of bolt, or, should this make it necessary to maintain too large a stock, the steps can be advanced by 1/32 in. equalling 6 in. length of bolt. The former reduces amount of reaming necessary and doubles number of step sizes. The latter increases the amount of reaming and reduces number of sizes.

The master gage Fig. 12 will serve to illustrate step sizes. This gage has a taper of 1/16 in. per ft. Graduating lines are spaced 3 in. apart, which for this taper increases the diameter 1/64 in. at each succeeding graduation. The gage shown is 1 in. diameter at the small end and has 15 in. of tapered surface which is a convenient length. Similar gages may be made for any desired diameter. If step sizes ad-

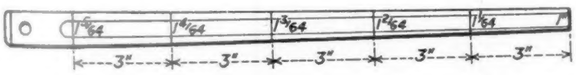


Fig. 12—Plug Gage for Step Sizes of Taper Bolts

vancing by 1/64 in. call for too great a variety of sizes, the intermediate graduations may be omitted. Such master step gages are valuable for maintaining standards of taper for bolts, grinding reamers and checking reamed holes. The graduating lines shown are used as step sizes, *i.e.*, the diameter of bolts directly under the head.

Internal Gages for Taper Bolts

In order to properly carry out a system of step sizes it is essential that suitable internal gages be provided. For measuring the diameter and the taper of bolts, internal work gages as shown in Fig. 13 are used to advantage by the bolt turner. These gages may be of soft steel or cast iron. The taper holes are carefully reamed to a size so that the desired graduation of the external gage, Fig. 12 comes flush with the face of this internal gage the diameter being stamped at each hole. The dimensions given in Fig. 13 meet the requirements for the average run of bolts. While frame bolts longer than 8 in. are common, it will be found that by turning to a gage of this length all necessary accuracy is readily obtained.

Each of the seven holes advances in diameter by 2/64 in. steps, which is entirely satisfactory. The complement of

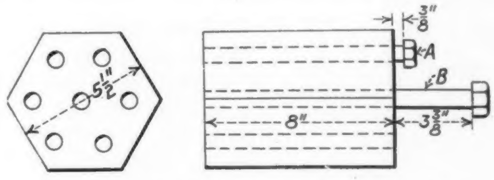


Fig. 13—Internal Gage for Fitting Taper Bolts

these gages should cover all diameters of frame bolts commonly used, which makes it necessary to provide several. However, when made of cast iron their cost is low in comparison to the economies that follow. These are generally made locally. In addition to bolt manufacture they are also used in the tool room when grinding reamers.

When finishing taper bolts, either on bolt skimming machines, turning, or other methods, the even 64th sizes such as 1-2/64, 1-4/64 in., etc., are machined to enter the gage so that the head projects approximately ⅜ in. from the face as shown at *A*. The intermediate sizes, such as 1-3/64, 1-5/64, etc., are machined to stand away 3-⅜ in. as shown at *B*. The ⅜-in. projection is the amount allowed for driving or drawing home. This reduces the number of holes in the gage by half and admits of accurately gaging all sizes coming within their range.

Machining and Fitting Taper Bolts

Machining and fitting taper frame bolts is now done in a number of ways, therefore no attempt will be made to describe all processes. The following explanations will dwell mainly on what may be called ideal methods and are described with the hope that some of the practices mentioned may be made use of and thereby result in an improvement over the practices commonly employed.

* This is the third of a series of articles, the first of which appeared in the June issue of the *Railway Mechanical Engineer*, describing the methods that have successfully been adopted on one of the large railroad systems and which have expedited locomotive maintenance work and reduced the cost.

It is desirable to manufacture frame bolts in large quantities in the central production shop in order to take advantage of the resulting economies, however, the great varieties of sizes required to meet conditions when repairing locomotives put certain limitations on quantity production. An explanation will first be given of special machines for finishing these bolts.

Bolt Skimming Machines

In the larger shops, under favorable conditions, taper frame bolts are economically finished in quantity production on bolt skimming machines. Where these machines are employed the rough forgings are first finished to one diameter for their entire length and also faced under the head by revolving the bolt in a hollow mill or skimmer. The bolt is then transferred to and finish turned on a second tapered hollow mill in the same machine which has two cutters or blades and two backers all of which are the full length of the bolt, these cutters being carefully set to a gage of the same taper as the bolt. Bolts finished in this manner are sufficiently accurate to meet general requirements. After finishing in this machine, the ends are threaded on regular bolt threaders. When required for use they are drawn from stock and driven into place without additional machining, the holes having been reamed to suitable step sizes. As previously mentioned, this is an economical method for machining taper frame bolts and is now employed to good advantage in the larger shops, which are warranted in carrying a large stock of these articles. However, owing to the almost endless variety of diameters and lengths required to meet the condition of re-reamed holes which should from necessity cover a range from the original or standard sizes gradually upwards through the many stages of enlargement, it would be necessary to keep a large variety in stock. This places certain limitations on this method of manufacture that should be carefully considered.

Roughing Out to Sizes Varying by 1/8 Inch

Another method is to forge, center both ends, rough turn, thread and place in stock. When required for use they are drawn from stock, turned to required diameter and applied. It is advisable where this practice is followed to rough turn to sizes governed by thread sizes, *i.e.*, a 1-1/8 in. bolt, 12 in. long and 1/16 taper per foot is rough turned 1-3/16 in. diameter except the threaded end, the diameter 1-3/16 coming just below the minimum size for a bolt threaded 1-1/8 in. Or, to put it another way, bolts threaded 1 in. are used for all sizes from the minimum to a point where the 1-1/8 in. bolt begins, after this the next or 1-1/4 in. size is used, this plan being followed for all diameters and lengths. This practice will reduce the varieties of bolts carried in stock to a minimum. Having the bolts rough turned, faced under the head and threaded reduces the time in repair shops when finishing to the various sizes for repair work. Considering the fact that bolts can be blanked out in the manufacturing shop in quantities at a correspondingly low cost makes this practice advantageous.

In the majority of the smaller shops bolts are turned directly from rough forgings to sizes required for fitting frames. This is a simple practice but much more expensive than semi-finishing in the manufacturing department.

Ideal Bolt Finishing Machine

There is a pressing need in the medium sized shop for a machine that may be in the form of the upright bolt skimming machine or the conventional form of horizontal bolt threading machine and equipped with a cutter head or similar device which will automatically enlarge when turning bolts from the small or point end to the large or head end and machine to the correct taper and diameter. These cutter heads, in addition to opening up to give the correct taper, should be readily adjustable from one size to another similar to changing the diameter of threading dies on a bolt cutter, the actual diameter being shown by an indicating dial which will admit of the operator changing from one diameter to another in a minimum time. The latter feature is necessary in order to meet the requirements of every day repair work and the many sizes demanded. A machine of this nature should have two or more heads in order to keep the operator fully employed when turning the longer bolts. Moreover each head should be driven by a separate clutch or motor in order to avoid stopping the entire machine when adjusting a single head. In addition it should be provided with cutter heads suitable for turning the straight part of the bolt to a suitable diameter for threading.

With a machine of this nature, taper bolts could be turned to the many sizes required and if provided with quick and accurate adjustment for cutters, the time of changing from one size to another should not be a serious consideration. With this ideal machine it would be necessary to carry only a stock of bolt forgings, every day's requirements being met by adjusting the cutter heads.

Too Much Time Lost Between Turnings

Under every day shop conditions it will generally be found that the time taken to turn bolts by any process is but a secondary consideration when compared to the time required to measure diameters of taper bolt holes in frames and cylinders, and in addition measure diameters of bolts during the process of turning, or possibly making several trials of bolts in holes. A greater amount of time is often consumed in going to and from the locomotive, trying bolts, etc., than in turning. It therefore follows that economies should be effected by reducing the time lost between bolt turnings, or adopting a practice whereby the operator when turning bolts does not leave his machine for the purpose of taking sizes.

Reaming Taper Holes

Two general plans may be followed when bolts have been previously finished to step sizes. One practice is to make use of a gage similar in general design to that shown in Fig. 12. When reaming, the hole is enlarged sufficiently to true up and also so that one of the graduations comes flush with the frame. That is, if when reaming, the hole can not be trued

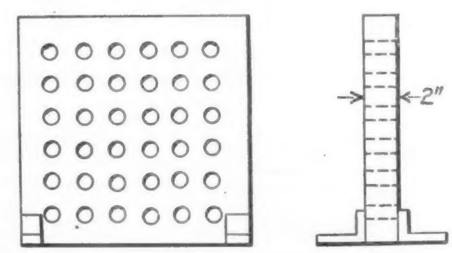


Fig. 14—Reference Block Gage for Step Diameters of Taper Bolts

for the 1-4/64 in. graduation, the reaming is continued until the 1-5/64 in. line comes flush, or continued until a full reamed hole is obtained. This results in a reamed hole to step sizes that may differ a minimum of 1/64 in. or 1/32 in. according to step sizes adopted. With taper holes reamed to the gage the finished bolts are drawn from stock and applied without further machine work. This in many respects is an ideal method, however, there are certain limitations such as the inconvenience of toting around the numerous taper gages required to meet all sizes, possibility of errors in measuring holes or bolts and the difficulty of keeping up the large stock of sizes.

Another plan is to gage the size of holes previous to reaming, draw finished bolts from stock of size a trifle larger than the holes and ream the holes to suit the bolts. This eliminates the errors that may creep in from defective reaming or bolt turning. This plan has a number of good points.

Another plan is to provide the erecting shops with internal gages as shown in Fig. 14 having a large number of accurately reamed and marked holes agreeing with step sizes. These are used either for measuring diameter of bolts or reamers. As they are only used for measuring diameters they need not be more than 2 in. thick. When in doubt as to sizes of bolts they are tested in the gage which provides a handy check for bolt sizes. They are also used for the purpose of gaging holes in the following manner. A reamer that appears satisfactory for the hole to be reamed is selected and placed in the frame hole. The distance it enters the hole being noted, the reamer is then placed in a suitably sized hole in the gage and chalk marked to agree with the face of gage or 3 in. distant. The hole is then reamed until the chalk mark comes flush with the frame. A rough and ready way of testing diameters of holes is to place the reamer in the hole and when held in the hand, the thumb nail is placed flush with the frame, the reamer withdrawn and placed in the gage and the position noted. While this is a crude way a man accustomed to the work can thus gage very accurately.

By this plan of gaging, the holes may be reamed to step sizes, finished bolts drawn from stock and applied, or the taper holes may be measured previous to reaming, bolts of anticipated sizes drawn from stock, holes reamed to suit bolts after which the bolts are driven into place.

In the event of the ideal bolt finishing machine being developed, or even when turning on center lathes by the use of these gages a memorandum of step sizes of bolts required can be made out at the locomotive and handed to the bolt finisher who would make up what is required from this list, the bolts being fitted to gages shown in Fig. 14. These may be of a size suitable to drive into the previously reamed holes, or to the anticipated sizes to admit of reaming holes to suit the bolts. By this plan the bolt turner would fit all bolts to gages and as a result would not leave his station for the purpose of taking sizes. This should increase the output with a corresponding reduction in costs. Moreover, fitting bolts to gages eventually results in an improvement in the grade of work.

(To be continued)

Railroad Master Blacksmiths Meet at Chicago

Good Attendance and Discussion of Technical Papers Mark the Twenty-Seventh Annual Convention

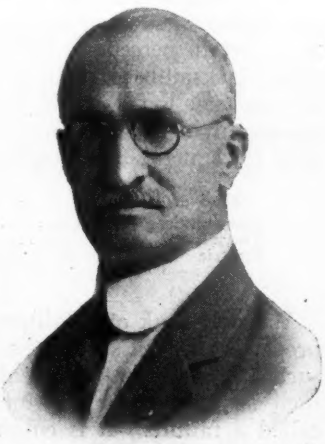
THE twenty-seventh annual convention of the International Railroad Master Blacksmiths' Association was held at the Hotel Sherman, Chicago, on August 21, 22 and 23. The last convention was held in 1920 and since long periods of inactivity in association work are usually followed by more or less of a lapse of interest, the officers were pleasantly surprised both at the attendance and the spirit shown. Seventy-eight members of the association, 46 supply men and 64 members of the Ladies' Auxiliary registered at the convention and were for the most part present at the opening session. The keynote of the convention was undoubtedly the desire of the members to build up the association and spread knowledge regarding the best railroad blacksmith shop practice to the mutual advantage of the members and the railroads which sent them.

The invocation was offered by C. B. Rowe, secretary of Y. M. C. A., and D. G. Gallagher, assistant corporation counsel of Chicago, welcomed the convention in the name of Mayor Dever. Joseph Grine (N. Y. C.), president of the association, delivered a short but forceful address outlining the object of the association and particularly its main object of enabling members to help solve each other's problems. He pointed out that while the blacksmith shop supervisory forces were pressed to the limit during the war their work is hardly less arduous now in building up depleted shop forces and meeting new problems.

At this point in the program the members were agreeably surprised to listen to an address by M. D. Franey, formerly master mechanic of the Lake Shore & Michigan Southern at Elkart, Ind. Mr. Franey paid a glowing tribute to the master craftsmen, not only in the blacksmith's but in other allied trades, who have served their apprenticeship and risen from the ranks to positions of authority. He testified to the practical value of association work and praised as broad gage the higher railroad officers who authorize their representatives to attend conventions.

One of the features of the convention was a moving picture showing the manufacture and use of oxygen and acetylene gas, this film being explained by Professor A. G. Kinsey (Air Reduction Sales Company) as it was shown. A varied

Joseph Grine (N. Y. C.)
President



George Hutton (N. Y. C.)
1st Vice-President

Samuel Lewis (Can. Nat.)
2nd Vice-President

W. J. Mayer (Mich. Central)
Secretary-Treasurer

entertainment program was provided for the ladies and both members and guests thoroughly enjoyed the annual banquet furnished through the courtesy of the Supply Men's Association.

The five technical sessions were well attended, the committee reports being listened to with good attention and followed by valuable discussions. Abstracts of some of the papers are given below and others will appear in subsequent issues.

Drop Forging

By P. T. Lavender

Norfolk & Western, Roanoke, Va.

For many hundred years metals were worked by hand forging, but with progress in the manufacture of various commodities it became necessary to replace this old method by a machine capable of turning out quantities of a given product, uniform in size and with a minimum waste of material. To accomplish this great saving, a drop hammer was built and proved to be a machine of great merits. It has been so developed in recent years that its products are too numerous to mention.

It eliminates the great waste of hand forging, by leaving on the finished piece a minimum allowance to be removed by machining operations. Hand forging left the piece of work with entirely too much stock to be removed by machining.

The drop hammer saves labor as compared with hand forging and also increases production from 10 to 20 times,

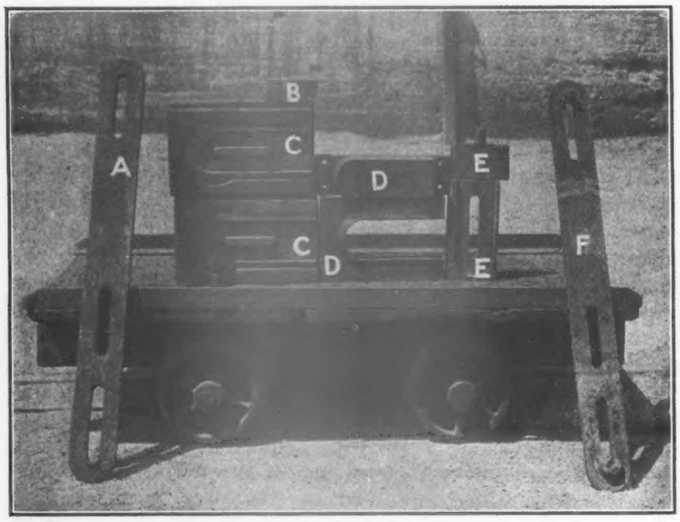


Fig. 1—Drop Forging Dies for Reclaiming Draft Gear Side Links

and in many cases more. Many pieces made by a drop hammer would require several heats in hand forging, which of course means a saving of fuel.

One of the distinct advantages of a drop hammer over other methods of forging is the compactness of the metal after the operation is completed. The work after being heated evenly to a yellow heat is placed under the hammer with the fiber in the same horizontal plane for each operation, thus each stroke of the hammer drives the fibers closer together. In no case is the work placed under the hammer such that it will be upset, for upsetting tends to drive the fibers away from each other, and thereby causes a spongy or porous effect in the grain of the finished work. Naturally a product with the grain driven close together will stand a greater tension or compression than one with the grain not so close together.

In order to secure a drop forging with minimum scale and minimum waste of metal and with a maximum production, it is necessary to have properly designed dies. These dies should be accurately machined and all vertical surfaces relieved five degrees. This relief enables the operator to free the work and seldom will it stick to a die. In most cases where the work sticks or hangs to the dies it is a faulty design and principally in relief.

Any material of 45 to 70-point carbon will make good dies. Old scrap driving wheel axles are very good, for this purpose. We do not heat treat dies but take them from the die room and put them into service. Wherever there is a sufficient amount of forgings to make, a drop hammer should be installed.

Dies used at the Roanoke shops for reclaiming the side links of Farlow draft gears are shown in Fig. 1, in which *A* is a scrap link and *B* a piece of material sufficient to reinforce the bearing at the end where the key works. This is placed on the scrap link *A* and both put into a furnace and brought to the proper heat. They are placed on die *C C* and stamped and then removed to the trimming press and the outside flash or excess material trimmed off by dies *D D*. Dies *E E* punch the slot as shown in the finished link *F*. You will note that the bearing at key seat has twice the wearing surface as the old one. These dies were a great help to us at Roanoke shops during the world war when we could not secure new material.

Frame Making and Repairing

Papers on the practices followed in frame making and repairing on various roads were submitted by C. H. Nutter, Boston & Maine, North Billerica, Mass.; G. W. Kelly, Central Railroad of New Jersey, Elizabeth, N. J., and T. F. Buckley, Delaware, Lackawanna & Western, Scranton, Pa.

Paper by C. H. Nutter

With the added facilities for autogenous welding at the present time, the repairing of frames has been reduced to a question of which method to use to get the best results at the least cost.

The introduction of the mechanical cutting torch enables new frame sections to be made from hammered steel billets, the most intricate shapes being cut and ready for use in a very few hours. New sections may be cut in such a way as to practically eliminate machine work except for shoe and wedge fits of jaws, cylinder fits and thickness of sections. Other parts can be cut to size, annealed and sent to the machine department in a very short time as compared to the old method of forging.

We are using the following kinds of welds: Oxy-acetylene, Thermit and electric and have no difficulty handling any one of them in a satisfactory manner.

It is useless for any of us to say that we do not have any failures. No matter what method is used, there is sure to be a certain percentage of failures, but it behooves the foreman blacksmith to so train his men who handle this class of repairs as to make this percentage as low as possible. The accompanying table shows welds made and how made in the year 1921 at the Billerica shop.

Kind of weld	Total number made	Number failures	Per cent
Oxy-acetylene	161	11	6.83
Thermit	37	6	16.2
Electric	7	1	14.3
	205	18	8.77

When I speak of a failure, it does not mean that the weld proper breaks but should the frame break near the weld or in such a manner that the weld was responsible for the break, such as improper expansion, improper methods, etc., it is called a failure. It is customary to run an engine into the shop to have a frame welded and there is not always time enough given to strip it in such a way that the proper ex-

pansion can be obtained. It, therefore, is not unreasonable to expect that the frame will break soon after its return to service. The total actual failures as shown in the table would have been only seven had the welds broken, for in 11 of the cases they broke at a point away from the weld which could not, therefore, be classed as failures in the strict sense of the word.

We keep a complete record of every weld made, who made it, and the date; also a sketch of the weld with a record of whether the expansion was perfect or not. We also stamp the welds made at the different points, with the shop mark carried at that point where weld is made and the date of making.

There are so many factors that enter into the breaking of frames, such as poor design, loose and improperly fitted shoes and wedges, loose binders, worn pins, loose rod wedges, loose bolts in frame braces, and last but not least, poor road bed, that we should have the co-operation of everyone from the lowest to the highest official, to bring the percentage of breakage as low as possible, and to keep locomotives in service.

We are applying new sections of a heavier design to such classes of engines on the Boston & Maine as were giving trouble, also adding frame tie castings where needed with very satisfactory results.

As proper expansion is essential to a good job, every effort should be made by the man in charge to see that the proper amount is given. In the case of acetylene welding, there are no two operators who use the same amount of expansion, as some weld faster than others, and great care should be taken in mating up the men to get the best results. Also, special training should be given to the men selected to weld frames, and a close check kept on their welding, to see that they are actually welding and not just filling in the vees. They should weld test pieces often and be shown the results of the tests. If the tests prove unsatisfactory they should be told why it is unsatisfactory, and should prove it for themselves by welding another piece for test purposes. No matter what process is used, only the most experienced men should be used at all times.

Paper by G. W. Kelly

The fact that the manufacture of locomotive frames has passed altogether into hands of the steel foundries which

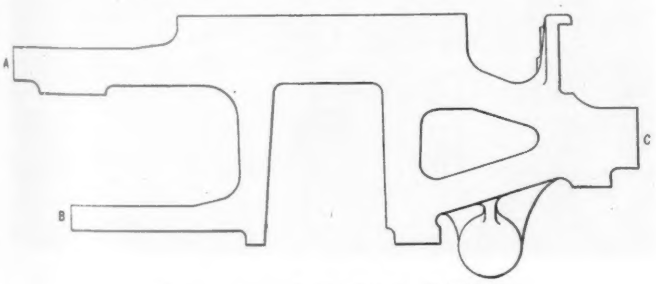


Fig. 2—Perferred Location of Welds

co-operate with the railroads in making frames of correct design and proper analyses does not relieve us of that most important duty of keeping frames in service. Steel frames have weaknesses as well as the wrought iron frames which

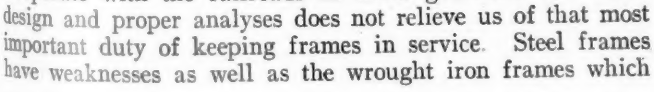


Fig. 3—Cast Steel Section Welded to Forged Frame

they superseded and it requires quick decision as to the best method to effect repairs to return the locomotive to service with the least possible delay. We now have the use of Thermit, oxy-acetylene and electric welding processes and it has been proven unnecessary to remove the frames. Since 1905 the Central Railroad of New Jersey has used principally the Thermit process and has made several hundred welds which made a permanent repair. Included with this paper are illustrated a few types of steel frame sections that

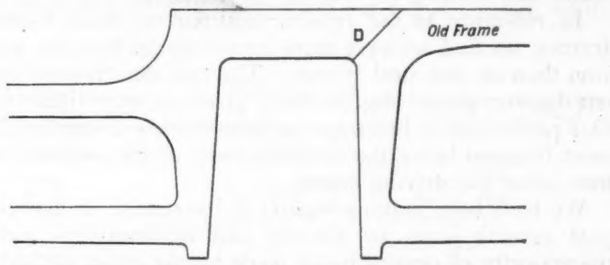


Fig. 4—With This Weld Allowance Must Be Made for Shrinkage

were welded on locomotives going through the shops for Class 2, 3 or 5 repairs. Frame sections such as shown in Fig. 2 were applied to about 45 locomotives; Fig. 3, 24 locomotives, and 25 locomotives had new frame sections similar to Fig. 3 except with two pedestals. The above sections were welded to wrought iron frames which were in first class condition.

We prefer, when possible, to make the welds at *A*, *B* and *C*, (Fig. 2). When making repairs to the older type locomotives, where the frame is broken at two or more places in one pedestal, a wrought section is made and welded in as shown by Figs. 4 or 5. The weld at *D* (Fig. 4) also makes a permanent repair if allowance for the contraction of the weld is correct.

There were many long discussions when the Thermit

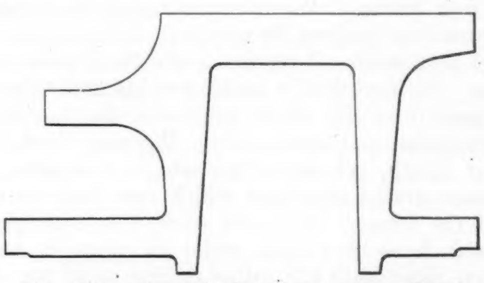


Fig. 5—Section Welded into Broken Frame

process was first introduced. At that time there were many failures and there are still some today, and there will continue to be failures where the operator does not exercise the proper care on the several points, which govern the making of a successful weld. We cannot emphasize too strongly the importance of proper allowance for contraction, particularly on the heavy sections where it is most difficult to obtain it.

By using long heats of charcoal on opposite rails or pedestals, we have practically eliminated the use of a spreading bar or jack. The latter must be used with the greatest care, whereas the uniform heating of all the rails with charcoal allows a natural contraction which may be timed with the contraction of the weld without tension or buckling in the welded rail or other members of the frame.

The perfect drying out of the mold, sufficient pre-heating and the proper timing of the reaction will insure a perfect weld.

Paper by T. F. Buckley

A discussion on frames at this time should treat largely on the changes that have come through the substitution of cast steel for wrought iron. In cast steel a frame can be made much stronger than one of wrought iron as there are many brackets and braces cast integral on the frames which eliminate the bolting that is necessary when these parts must be fastened separately to wrought iron frames. It is now the aim of the mechanical departments to combine such braces

as guide yoke knees, brake fulcrum brackets, reverse lever brackets, crossbrace knees, etc., solid with the frames. This practice can readily be followed with cast steel frames and the necessity for drilling for these braces is thereby eliminated. This plan with the cast steel frame strengthens the frame and reduces the liability of breaking.

In reference to the repairs required on main locomotive frames, we find we have more repairs to be done on wrought iron than on cast steel frames. The cast steel frames used on our heavier power engines have given us very little trouble. Our percentage of breakage on these frames is very small, the most frequent being the cracking away of the pedestal binder toes below the driving boxes.

We have been making repairs to locomotive frames for the past several years by electric and oxy-acetylene welding, the majority of repairs being made by the latter method, and have been getting good results from such repairs. We find the best method in repairing frames by acetylene gas is by using two torches, one on each side of the weld, until the work is finished. We cut all the welds in V-shape, to an angle of about 45 deg. and make sure that the scarf is clean where the weld is to be made. It is very important in making the weld to provide for proper expansion, this being difficult to describe as it is governed by the design of the frames and location of the weld. It is also necessary to have capable, experienced welders on this class of work. As previously stated, we are getting satisfactory results from the oxy-acetylene welding, but have also been well satisfied with results obtained by the other welding processes, notably the electric.

The largest percentage of frame repairs is on our older engines, built 12 or 15 years ago and having light section wrought iron frames. We have not generally removed any frames from these engines for welding during the past several years, but have made all repairs while the frames are under the engine. We find that in making welds under the engines, that at times it is difficult or impossible to provide for the proper expansion and contraction. We may think we have the correct length, yet when the weld is completed find we have thrown strains elsewhere which may later cause other failure of the frames. It is the writer's opinion that when several welds have been made under an engine in one frame section that when this particular engine is in the shop for general repairs, the frame should be removed, sent to the blacksmith shop for annealing and have the old welds examined. If necessary they can be worked over and all strains removed and the frames made to the proper dimensions in all particulars. Unless this is done good permanent results will not be obtained.

Discussion on Frame Welding

The papers on frame making and repairing were followed by an animated discussion of the various points brought out. H. W. Loughridge (P. & L. E.), McKees Rocks, Pa., emphasized what had already been said about the necessity of relieving strains after welding and stated that cast steel frames on the Pittsburgh & Lake Erie are giving satisfactory service with the exception of occasional broken pedestal toes, which may usually be traced to poorly fitted binders, loose shoes and wedges or rods pounding. M. C. Whelan (St. L.-S. F.), Kansas City, Mo., commented strongly on the so-called expert oxy-acetylene operators who claim to know more about expansion than the master blacksmith. Mr. Whelan described in detail by means of a blackboard some of the methods employed in making various frame welds on the St. Louis-San Francisco. G. W. Kelley stated that the next step in locomotive design would be the provision of rolled slab frames, cut out with the acetylene torch to the required shape. Joseph Grine (N. Y. C.), Depew, N. Y., said that in electric welding it was essential not to cut out more metal than necessary but that enough must be removed so that the operator can get at the weld. The type of electrode and the work of the operators must be subject to constant surveillance. Mr. Grine said that the New York Central has electric welded frames running since 1912 without giving any trouble. The welds are cut out to 45 deg. and reinforced where possible, using only the electrode. All frame welds are made without pre-heating, usually getting the expansion by means of a wedge. When necessary with this method the operator can be taken off the job and the weld completed at some later time, there being so little difficulty with expansion.

Shop Tools and Formers

Papers were submitted by G. H. Corcoran, Grand Trunk, Battle Creek, Mich., and H. W. Loughridge, Pittsburgh & Lake Erie, McKees Rocks, Pa.

Paper by G. H. Corcoran

If a foreman cannot get modern machines and tools, he must either make substitutes or get along without. It has not been so difficult of late years to get modern tools. If one can show the management in figures how a saving can be made, they are quick to take advantage of the situation and supply the tools.

A shop equipped with plenty of steam hammers is indeed fortunate and for all around purposes, the power hammer, either electric or steam driven, takes the lead in the smith shop. Those shops equipped with forging machines, drop hammers, shears and punch, bolt bulldozers, etc., with plenty of power behind them, are in the number one class, that is, if they are provided with machinists and tool makers to take care of their machines and make new tools.

In some cases, the job is done in the old fashioned way simply because a foreman uses good judgment in not making a tool for the job when there would not be enough of that particular work to pay for making the tool. Many foremen make new tools that do not pay, but make them to show off what they can do, and hang up another sample on the exhibition board. This is a poor proposition for the company. There are cases where it pays to make a tool for a single job, of course, but this would apply only to extreme cases, such as a pair of hammer dies for welding a heavy link under a steam hammer as it is easier to handle, makes a safer weld and a better looking job.

Fig. 6—Twelve-Inch Air Brake Cylinder Set Up for Making Pipe Clips

One of the biggest and best helps for lathe work is to have stock cut just to the exact length so as to avoid facing ends of the job. A cold metal rapid cutting saw is a fine tool for this class of work and every smith shop should have one for it will soon pay for itself in the saving of machining. Often it costs more to face off a job that is too long than the job itself would cost when it is the right length. Another big saving of machine shop work is the forging to correct diameter

of spring hanger pins and bushings. All pins and bushings are made on forging machines and are made very closely to size. In connection with forging of bushings to correct inside diameter, it has been found that the scaled surface wears much longer than those which are machined before case hardening.

A 12-in. air brake cylinder that has been discarded can be made into a small bulldozer and with a small face plate makes a very useful tool for all kinds of bending. One of these devices used for making pipe clips is shown in Fig. 6. It is located at a forge and has dies for all different sizes of pipe. It has a back stop fastened to the face plate and none

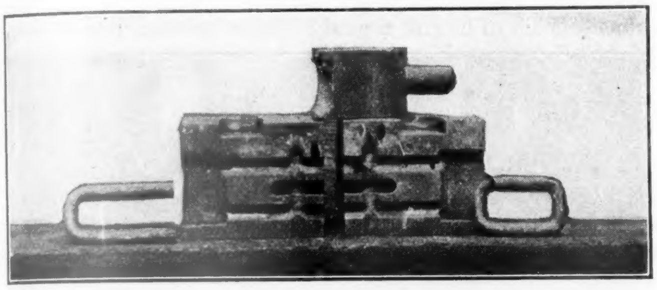


Fig. 7—Dies for Welding ¾-In. End Gate Hinge Link

of the dies are bolted to face plate. On the crosshead, dies may or may not be fastened. Owing to the many sizes of pipe clips wanted, a quick exchange of dies can be made. This air machine is a shop-made tool and can be used for many purposes besides making clips.

Tools for bending metal cold have always been in prac-

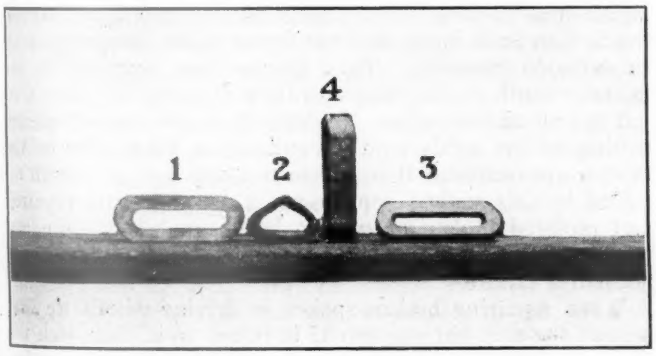


Fig. 8—Links Punched Under a Steam Hammer

tice more or less in the smith shop, but of recent years it is becoming more common as heavier parts are used to employ presses and bulldozers. Also the punch machine is used for bending iron in many shapes, squaring up staybolts and for other purposes too numerous to mention.

Paper by H. W. Loughridge

The tools and formers needed today are those that are in use for each month's requisition, those that give you an increased production at a decreased cost.

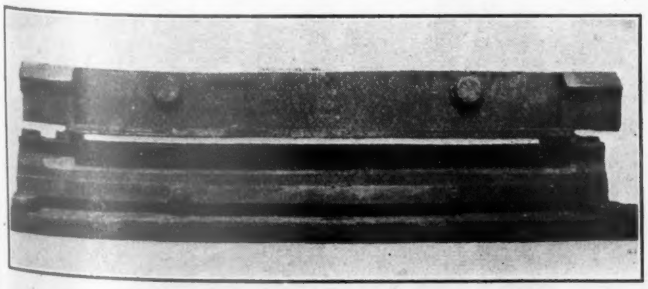


Fig. 9—Device for Bending Freight Car Sill Steps

Fig. 7 shows a set of dies for welding ¾-in. end gate hinge links. The link is first bent in a bulldozer. The other end is then welded by one pass of the forging machine. The recess in rear of dies is for the tong hold.

Links punched under a steam hammer are shown in Fig. 8, *1*, *3* and *4* being chain links for a flue cleaner, while

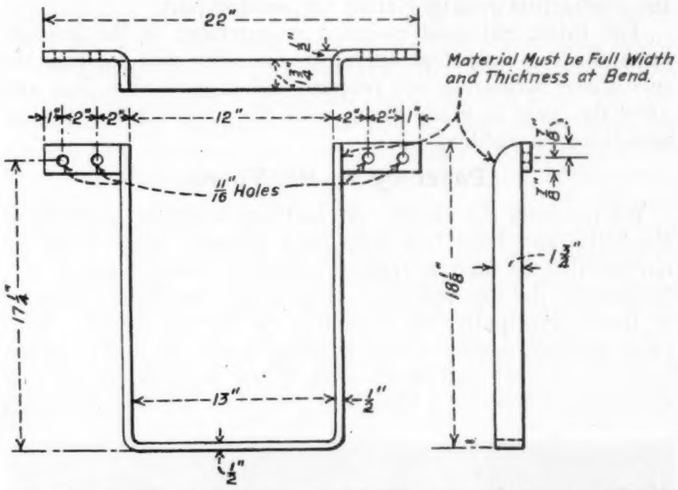


Fig. 10—Details of Freight Car Sill Step Made in Former (Fig. 9)

2 is drop door link used in connection with drop door hinges. If links and hinges are made from soft steel bar, five or six can be made in one heat. The practice at the P. & L. E. shops is to use scrap ends of material sheared to fit in die. By this method 25 or 30 can be kept in furnace, giving a continuous production.

Fig. 9 shows a device for bending freight car sill steps, made as shown in the drawing, Fig. 10. The material is inserted in the bottom step of the former where the ends are bent on the edge to a 90 deg. right and left angle. Then the material is placed in the upper step where the vee part of the die forms the angle on the ends or pads. They are then bent on a regular sill step formerly used as third step.

Autogenous Welding

Papers on the subject of welding were submitted by W. F. Keller, Michigan Central, Jackson, Mich., and A. W. Young, New York, New Haven & Hartford, Readville, Mass.

Paper by W. F. Keller

Autogenous welding has become one of the greatest mechanical processes that has ever been taken up in railroad work and to get the full benefit of welding there are three things that must be considered. First, is the proper application of the method to be used, Thermit, oxy-acetylene or electric. To be in a position to get desired results in this respect shops should be equipped with the different welding appliances so that when the various jobs that are to be welded come up for consideration the one in charge will not have to do the work with one process where another should be used. One cannot use any one of the three welding methods exclusively and get by with it successfully.

Another practice in the application of welding processes that needs consideration is the use of the cutting method. In a good many shops a mechanic and helper will be assigned to do some work of a stripping or assembling nature and on account of the dependence on gas cutting there is a great amount of time lost in waiting for a burner where the job could and should be done by other methods. It has been found that the use of the process in this particular respect has caused much extravagance.

The next prime essential to successful welding is the preparation of the broken part to be welded. The big con-

sideration in this respect is the matter of expansion and contraction and as each job presents a different condition in this regard one must realize first what should be done to prevent the weld in question developing undue strain. This condition will be found mostly in welding of frames and fire boxes or any job where both ends are tied and will not give freely to the contraction required from the welded part.

The third and most essential requirement in the welding business is a competent operator—one who will see that the two above necessities are properly taken care of before and after the weld is made along with the proper fusion of the metals to be applied.

Paper by A. W. Young

We use both the electric arc and oxy-acetylene methods at Readville and have had very good success. Practically all our welding on boilers, frames, cylinders, brake rigging, etc., is done by the oxy-acetylene process and the electric process is used principally for building chafes on frames, worn parts of link motion work, welding cracks in boiler sheets, welding in flues and other work where there is liability of distortion if done by a high heat process. We find that each

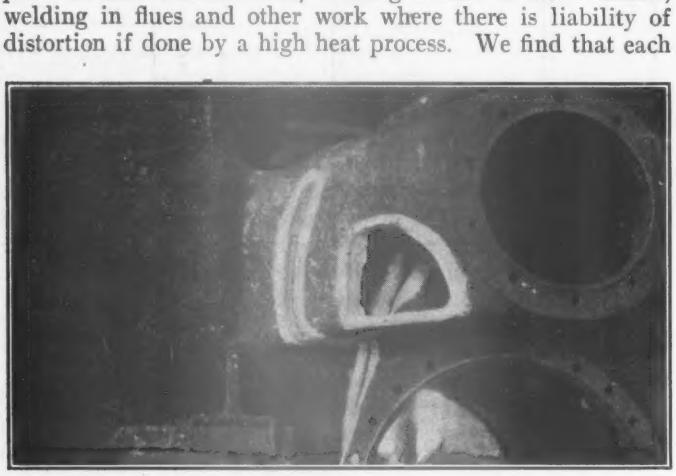


Fig. 11—Cylinder with Cracked Internal and External Port Walls Ready for Welding with Bronze

process has its particular field, although the great advantage of cutting is wholly confined to be oxy-acetylene process.

Our method of procedure with welding in general is as follows:

All work of any description is first cleaned, then scarfed with cutting torch to an angle of about 45 deg. Surfaces to be welded are then chipped or ground, care being taken that all oxidized metal is removed. Work is then assembled with proper allowance made for contraction, after which the article is welded, using the metal suitable to the particular work being done; that is, iron welding rod where broken parts are iron, steel welding rod where parts are steel, and invariably Tobin bronze for cast iron. All broken cylinders and other cast iron parts are repaired with bronze. We have adopted this method of repairing the cylinders after long experience and have had no failures when the bronze is properly applied. We find there is less brittleness and more elasticity with the bronze than with the cast iron rod. The preheating in the use of this metal is simplified for the reason that it does not require the building of a brick furnace around the cylinder and as before mentioned, the bronze has eliminated failures. We also use bronze for building up piston heads, valve stem cross-heads and innumerable other pieces and find it easily applied and very serviceable.

In repairing cylinders (Fig. 11), we proceed as follows: Scarf the broken or cracked section, allowing at least one-

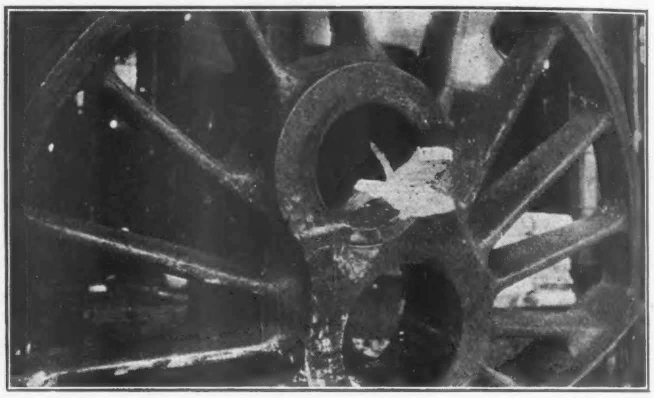


Fig. 12—Wheel Center Cracked Through Crank Pin Hole Ready for Welding

eighth inch opening at the bottom of the scarf. A charcoal fire is then built inside the cylinder or valve chamber or both as occasion requires. This fire is kept burning in the cylinder until the welding operation is completed and then left to cool off naturally. No drilling or pinning is required, neither do the welds require caulking as when done by the electric arc method. It is seldom that any part of a seam repaired by this method requires caulking. We have repaired and replaced broken parts of a large number of cylinders, using as high as 190 pounds of bronze per cylinder and have not had a failure.

When repairing broken spokes in driving wheels we first remove the tire, cut the rim if it is not split, then jack the rim out thus allowing for contraction. After the spokes are welded and cooled off the rim is again welded which removes all strain from the welded spokes. The same practice is followed when repairing frames, etc. An unusual wheel center welding job is shown in Fig. 12.

This report would be incomplete were I to neglect to make mention of the Oxygraph machine placed in the shops by the Railway Oxweld Service Company. This is

Many Prominent Railroad Master Blacksmiths and Supply Men Wer Present with Their Families at the 27th Annual Banquet

without a doubt the greatest labor-saving and largest producing machine on flat material that has been brought out in recent years and covers a great variety of work without any special appliances. This machine is used for making any shaped part from flat stock as follows: Spring equalizers, truck equalizers, eccentric crank arms, eccentric rod forks, eccentric rod heads, sections of locomotive frames, side and main rod heads, main rod straps, union links, hooks—all shapes, brake forks, brake hangers, spring hangers.

In addition to the above it is used for hundreds of other pieces too numerous to mention. All work is annealed after cutting on this machine.

As we get deeper into the autogenous welding subject the more interesting it becomes. There is no end to the economies both in time and material which can be accomplished by these various processes.

Other Association Business

A committee appointed two years ago to consider affiliation with the American Railway Association reported that it had a letter from Secretary Hawthorne saying that the American Railway Association was not expanding its activities at the present time and that he would keep the Master Blacksmiths' Association in touch with developments. The report of the committee was accepted and the committee discharged.

The secretary requested that every member consider himself a committee of one to send the secretary a list of master blacksmiths in his vicinity in order that they may be duly notified and induced to attend the convention next year. Mr. Hutton pointed out that where written requests for permission to attend the convention are made out in proper form one or two months in advance, there is seldom any difficulty in master blacksmiths getting permission to attend the convention and receive legitimate traveling expenses. A resolution of thanks was extended to the railroad managements through whose courtesy the members were enabled to attend the present convention.

The following officers were elected for the ensuing year: President, George Hutton (N. Y. C.), West Albany, N. Y.; first vice-president, J. J. Eagan (N. Y., N. H. & H.), New Haven, Conn.; second vice-president, H. W. Loughridge (P. & L. E.), McKee's Rocks, Pa.; W. J. Mayer (M. C.), Detroit, Mich., was re-elected to the office of secretary-treasurer and C. H. Nutter (B. & M.), North Billerica, Mass., was appointed chairman of the executive committee. In view of its central location and facilities for taking care of conventions, Chicago was selected as the place for the 1924 Master Blacksmiths' Convention.

Exhibitors

Forty-six representatives of railway supply companies registered at the convention, the following companies having exhibits:

Air Reduction Sales Company, New York.—Oxygen and acetylene tanks, hand and automatic welding and cutting equipment. Represented by G. Van Alstyne, G. E. Phelps, R. F. Helmkamp, E. M. Sexton, B. N. Law, R. O. Mueller and R. Peabody.

Ajax Manufacturing Company, Cleveland, Ohio.—Model of four-inch new model twin gear upsetting forging machine; upset railway forgings. Represented by J. R. Blakeslee, J. A. Murray, A. L. Guilford, R. W. Bannerman, W. W. Criley and C. W. Wicks.

Anti Borax Compound Co., Ft. Wayne, Ind.—Welding flux for cast iron and brazing flux. Represented by Charles O. Klane.

Bell & Gossett Company.—Case hardening compound. Represented by E. J. Gossett.

Buffalo Forge Company, Buffalo, N. Y.—Steel plate pressure blower with direct-connected motor drive. Represented by W. J. McDowell.

Garlock Packing Company, Palmyra, N. Y.—Garlock packings, gasket material and pump valves. Represented by John L. Fisher and C. W. Sullivan.

Jackman & Co., E. S., Chicago.—Literature on Firth-Sterling tool and die steels. Represented by E. T. Jackman.

Metal & Thermit Company, New York—Represented by H. S. Mann and W. H. Moore.

National Machinery Company, Tiffin, Ohio.—Forging machine and bolt machine products. Represented by E. R. Frost, F. W. Klenk, C. D. Harmon, F. J. Mawby and K. L. Ernst.

Railway Journal, Chicago.—Represented by E. C. Cook.

Railway Mechanical Engineer, New York.—Represented by C. B. Peck and E. L. Woodward.

Tool Foremen's Convention

The American Railway Tool Foremen's Association held its eleventh annual convention at the Hotel Sherman, Chicago, on August 29, 30 and 31. About 80 members and guests were present at the opening session. After the usual opening exercises J. B. Hasty (A. T. & S. F.), president of the association, delivered a brief address, expressing regret at the absence of old faces caused by death or members leaving railroad service and pointing out that the only way for the association to grow in size and accomplishments is for the 21 new members this year to frankly accept their share of the responsibility. He pointed out the value of improved methods of handling tool room work and stated that the only way this work can be raised to the desired standard will be by the mutual exchange of experience of the members of the association. The possible economy from standardizing tools used in railroad shops is well known and this work can be best carried out through the Tool Foremen's Association. A great deal has already been accomplished along this line but standardization of shop tools should be carried much further. Tool foremen can also be of great value to the railroads employing them by studying and developing tools which will increase the efficiency of machine operations. In view of the high cost of labor at the present time, more production per man is needed in order to keep costs within reason in all industries including the railroad industry. The production of machine operators is so largely dependent upon the kind and condition of the cutting tools, jigs and fixtures that these accessories deserve the closest study of expert tool makers. The value of the competent tool foreman in speeding up production by this means can hardly be overestimated.

Following Mr. Hasty, Past President J. J. Sheehan (N. & W.), was called on for some remarks, which he made as follows: "One man can not see all the angles to a problem and it is, therefore, a good idea for tool foremen to come together and exchange experiences to their mutual advantage and for the benefit of the railroads which they represent. Tool foremen have had strenuous times during the last few years on account of the war and unsettled labor conditions, the effects of these conditions being felt almost as much by the tool foremen as by other shop supervisors. . . ."

One of the important features of the convention was the address by H. T. Bentley, general superintendent of motive power and machinery of the Chicago & North Western.

Committee reports were presented on the following subjects which were quite generally discussed:

Forming and Combination Punches and Dies.
General Tool Grinding and Use of Jigs on Grinders.
Forging Machine Dies.
Jigs and Devices for Locomotive and Car Shops.
Reclamation of Shop Tools and Shop Equipment.

The officers elected for the coming year were as follows: G. W. Smith (A. T. & S. F.), president; Charles Helm (C. M. & St. P.), first vice-president; George Tothill (B. R. & P.), second vice-president; E. A. Hildebrandt (C. C. C. & St. L.), third vice-president; W. C. Stephenson (A. C. L.), secretary-treasurer and J. S. Duca (C. R. I. & P.), assistant secretary-treasurer. R. D. Fletcher, retiring secretary-treasurer was presented with a pin and cuff links and also made an honorary member of the association in recognition of his meritorious services.

Abstracts of the papers and further details of the convention will be published in the next issue.

The Missouri Court of Appeals (St. Louis) holds that an engine being prepared to take out a train of cars, some of which were loaded with interstate freight was engaged in interstate commerce, and one employed in so preparing it was within the act.

Erecting Shop Practice on the Southern Pacific

Efficient Devices and Methods for Expediting Erecting Shop Work at the Sacramento Shops Are Described

By H. C. Venter
General Foreman, Southern Pacific, Sacramento, Cal.

THE growing demands for transportation throughout the country have burdened the mechanical department of the railroads so that it has become a problem to provide sufficient motive power. New locomotives must be purchased and old ones kept in good repair, and in this maintenance work there is no shop department more important than the erecting shop. The erecting shop is one of the essential links upon which the transportation department must depend for its locomotives.

Much has been said in the past about scheduling locomotives through the shop in as short a time as possible, but scheduling on one road may not be practical on a road a few hundred miles away. It can, however, be impressed on all those in charge that first class workmanship is required in repair work, particularly in the erecting shop, in order to produce locomotives which can give the service expected of them today. It is well to have a record showing a large output, but good workmanship must not be sacrificed.

Locomotives undergoing general repairs in the erecting shops should be thoroughly inspected and the inspector's reports, in conjunction with the work reports, will form a basis for a decision as to what parts must be taken down for renewal or repair. Particular attention should be paid to cylinder bolting, lining and bracing frames, laying out shoes and wedges, counterbalancing, connecting up the motion work and valve setting, as upon careful performance of this work depends the locomotive mileage between shoppings. If this work is properly taken care of at the general shops, it will prevent a great deal of running repair work at roundhouses.

Fig. 1—Method of Using Locomotive Binder Truck

The difficulty of erecting shop work and work in some of the other shop departments has been greatly increased in recent years by the auxiliaries for fuel and power conservation with which modern power is equipped. The maintenance of superheaters, feedwater heaters, automatic stokers, boosters, etc., places an additional responsibility on the mechanical department. The amount of capital invested for these auxiliaries is an imperative reason why erecting shops must turn out locomotives able to meet the demands and expectations of the managements. To do all that is expected in the erecting shop with the present shortage of competent mechanics and in view of the increasingly large and heavy locomotive parts, it becomes necessary to utilize time-saving devices wherever possible and those described in this article have proved valuable at the general shops of the Southern Pacific, Sacramento, Cal.

Labor-Saving Devices

The two-wheel truck, illustrated in Fig. 1, is used for applying frame binders, one man easily handling the heaviest binders while being fitted to the pedestal jaws. As shown in the illustration, the device consists of a pair of substantial truck wheels and axle to which is bolted a light but strong framework, reinforced by welded cross braces. Heavy binders can not only be moved about the shop on this truck, but can be applied to the pedestal jaws with much less physical effort than formerly required.

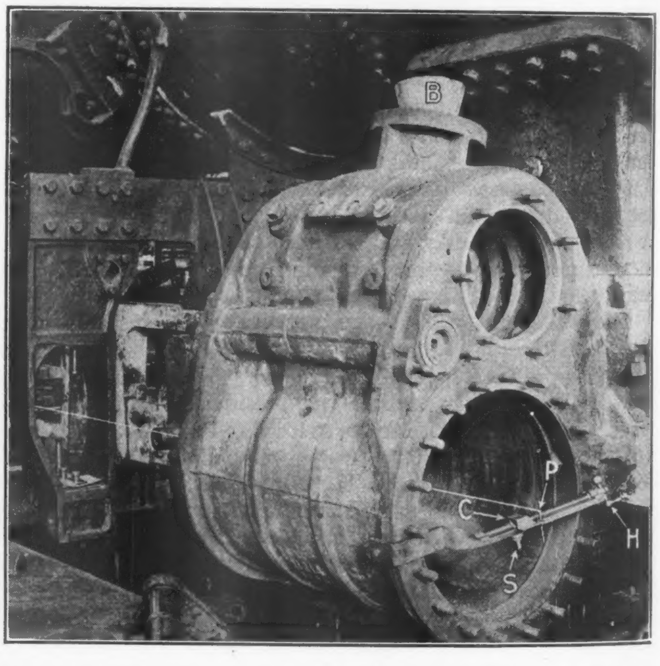


Fig. 2—Convenient Jig for Holding and Adjusting Cylinder Center Line

A convenient jig, providing easy adjustment of the cylinder center line used when squaring frames or laying out shoes and wedges, is illustrated in Fig. 2. This jig consists of a 2-in. by 5/8-in. metal bar shaped as shown and bolted to the front of the cylinder in an approximately horizontal position. Crosshead *C* is capable of adjustment along this bar by means of an adjusting screw and handle *H*, being held in any desired position by the large thumb screw *S*. The center line is attached to the upper end of a 1/4-in. threaded pin *P*, which is adjustable up and down by means

of two ¼-in. nuts not very clearly shown in the illustration. The other end of the center line is held by a similar arrangement bolted to one of the frame jaws. The center line thus has screw adjustment to the right and left and up and down, at each end. It can be quickly and accurately adjusted to the center of the cylinder, considerable time being saved over former methods of holding the center line.

Attention is called to the wooden block, B (Fig. 2) inserted

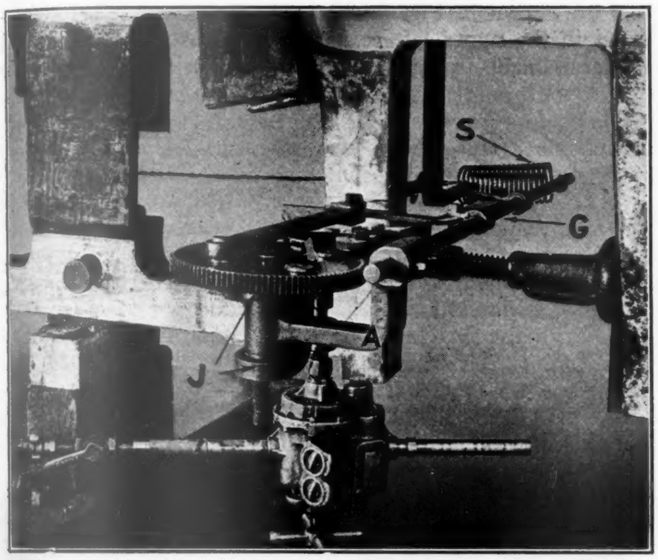


Fig. 3—Power Hack Saw Cutting Out Frame Section

in the steam pipe connection to the valve chamber. This block prevents nuts and dirt from falling into the valve chamber, or steam ports, and causing subsequent trouble after the piston and main valve have been reassembled and the cylinder heads applied.

The Sacramento shops have a standard practice in making oil frame welds which has worked successfully for the past five years with a small percentage of failures. In connec-

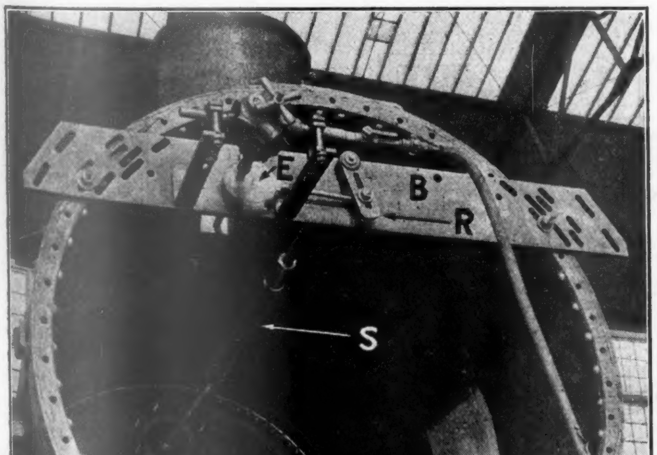
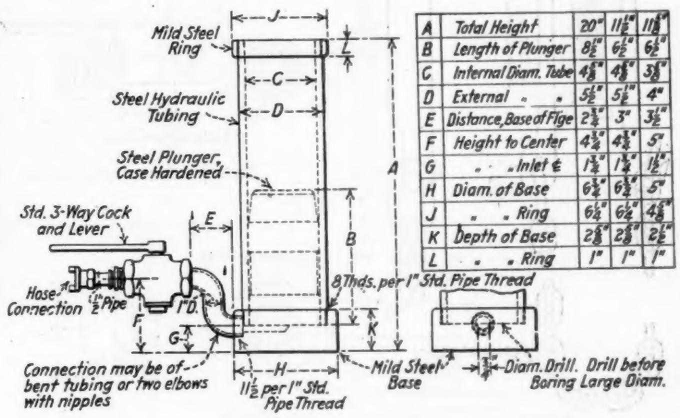


Fig. 4—Pneumatic Device for Grinding Dry Pipe Joint in Flue Sheet

tion with these welds, the power hack saw illustrated in Fig. 3, is used to good advantage and is an important timesaver. The saw can be set up in either a vertical or horizontal position and used to cut out frame sections as desired.

Referring to Fig. 3, the construction and use of this power hack saw will be evident. It is driven through a pair of spur gears by a pneumatic motor, the main saw framework being held firmly against the frame section to be cut by means of a jack or other convenient method. The saw blade is given a reciprocating motion by means of a crank pin on the large spur gear shown. Substantial arm A pivots on a pin held between jaws J and carrying on its upper end the large spur gear. To arm A is attached the guiding bar G for the saw frame. The pressure of the saw blade on the frame can be adjusted to the proper amount for most efficient cutting by means of spring S which can be put in tension by means of the string shown at the left of the frame jaw.

The method of grinding dry pipes to the flue sheet is illustrated in Fig. 4. A large plate B, provided with suitable slots to accommodate the largest boilers is bolted to the smoke box ring as shown. To it is attached the brackets for supporting the driving motor and the eccentric E which gives a reciprocating motion to arm R. This causes the shaft S



A	Total Height	20"	11½"	11½"
B	Length of Plunger	8½"	6½"	6½"
C	Internal Diam. Tube	4⅝"	4⅝"	3⅝"
D	External " "	5½"	5½"	4"
E	Distance, Base of Flge	2¾"	3"	3½"
F	Height to Center	4¾"	4¾"	5"
G	" " Inlet ℄	1¾"	1¾"	1½"
H	Diam. of Base	6¾"	6¾"	5"
J	" " Ring	6¼"	6¼"	4⅝"
K	Depth of Base	2⅝"	2⅝"	2½"
L	" " Ring	1"	1"	1"

Fig. 5—An Effective Pneumatic Bolt Extractor

and dry pipe to make a partial revolution first in one direction and then in the other, the amount of motion being adjustable by means of the nut and slot in arm R. The pressure of the dry pipe against its joint in the flue sheet can be governed by means of adjusting nuts on shaft S. This pressure must be relieved occasionally and the dry pipe backed out for inspection of the joint and renewal of the abrasive and oil, if necessary. Experience with this device has shown that heavy dry pipes can be ground in quickly and with practically no physical effort as compared to former methods of hand grinding.

The device illustrated in Fig. 5 is used for extracting bolts and materially speeds up this time-consuming operation. The device consists of a base plate of mild steel counterbored to receive the steel tubing shown, the latter being reinforced at the upper end by a mild steel ring. A plunger is provided, being ground to a sliding fit in the tubing and tapered at the upper end to allow for some upsetting action without sticking in tubing. Air from the shop line is supplied to the base through a standard three-way cock as shown. In operation, this device is applied over the end of the bolt to be removed and operation of the lever admits air beneath the plunger, driving it against the end of the bolt. Returning the lever to its first position shuts off the air supply and releases air from the tubing, allowing the plunger to return. This operation is continued until the bolt is started. Particular care must be taken to support the bolt extractor rigidly and in line with the bolt. This bolt extractor is made in three sizes to accommodate different sized bolts. The dimensions and method of construction are clearly shown in the drawing.

An efficient device for pulling locomotive driver and trailer springs in applying spring hangers and pins is illustrated in Fig. 6. This spring puller consists, as is ordinarily the case, of a yoke and chain and adjusting screw. The par-

ticular feature in this case is the ball bearing race at the bottom of the screw with twelve ¼-in. steel balls, enabling springs to be pulled with as little loss of effort due to friction as possible. This design also has been worked out to provide maximum clearance for the engine frames.

A tread gage for measuring tire wear at both the flange

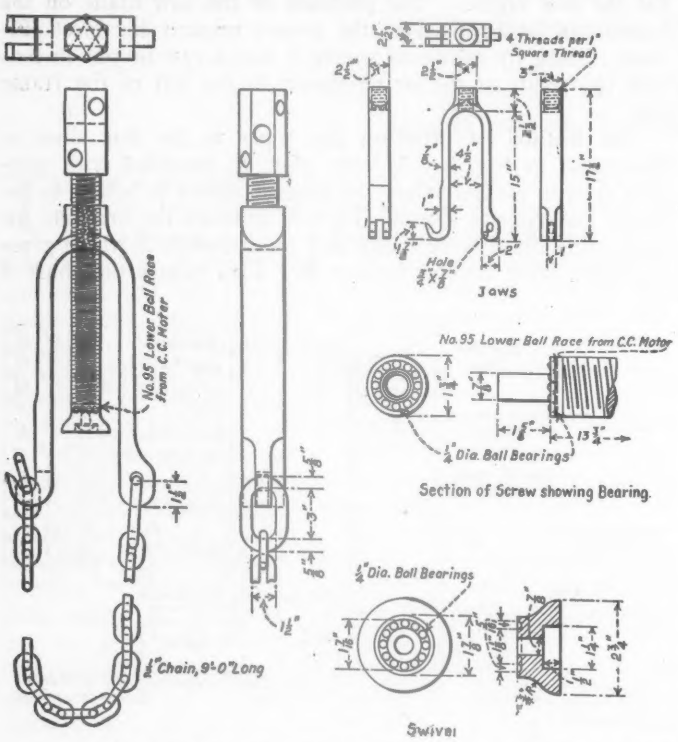


Fig. 6—Driver and Trailer Spring Puller with Ball Bearing Swivel

and tread is illustrated in Fig. 7. This gage is made of a scrap, hand saw blade and conforms to the standard tire contour. Two fingers are provided, as shown, to indicate the flange and tread wear, these fingers being graduated in sixteenths of an inch at the ends. A particular advantage of this type of gage is the fact that it can be applied to worn tires in places where the light is not very good and then taken to a good light to read the graduations.

A portable tire-turning tool, which has proved successful in cutting down flanges over the I.C.C. limit, is illustrated in Fig. 8. By using this tool, it is not necessary to drop the wheels on locomotives in order to cut the flanges down to the proper height and keep the locomotives in service until ready for general repairs. The details of the portable tire turning tool are shown in Fig. 8, the method of using it being indicated in the upper left corner of the illustration. The tool holder is made in right and left types, being applied to the

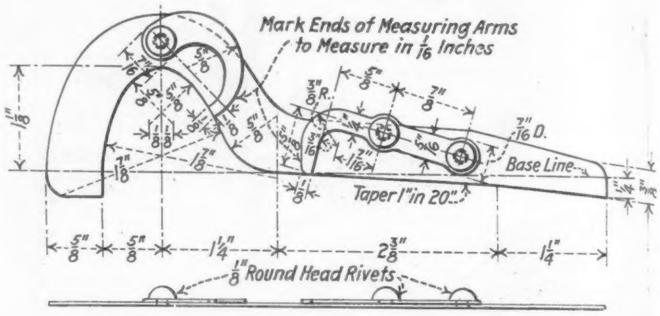


Fig. 7—Gage for Measuring Wear of Flange and Tread

brake hanger pin on which it pivots. The cutting tool is secured by two set screws in one end of the holder and rests on the tire flange. A roller in the other end of the holder also rests on the tire flange, being adjusted readily with respect to the driving wheel by means of a steel feed nut. It is obvious that revolution of this feed nut in the proper direction will increase the pressure of the cutting tool on the flange, when running the locomotive along the track will cause a chip to be taken from the flange. Three different types of tools are used for the first, second and finish operations, as shown in the illustration. It will be noted that the feed nut is turned by means of a small ¾-in. hexagon bar inserted in suitable holes in the nut.

A jig for plumbing crank pins in obtaining the position

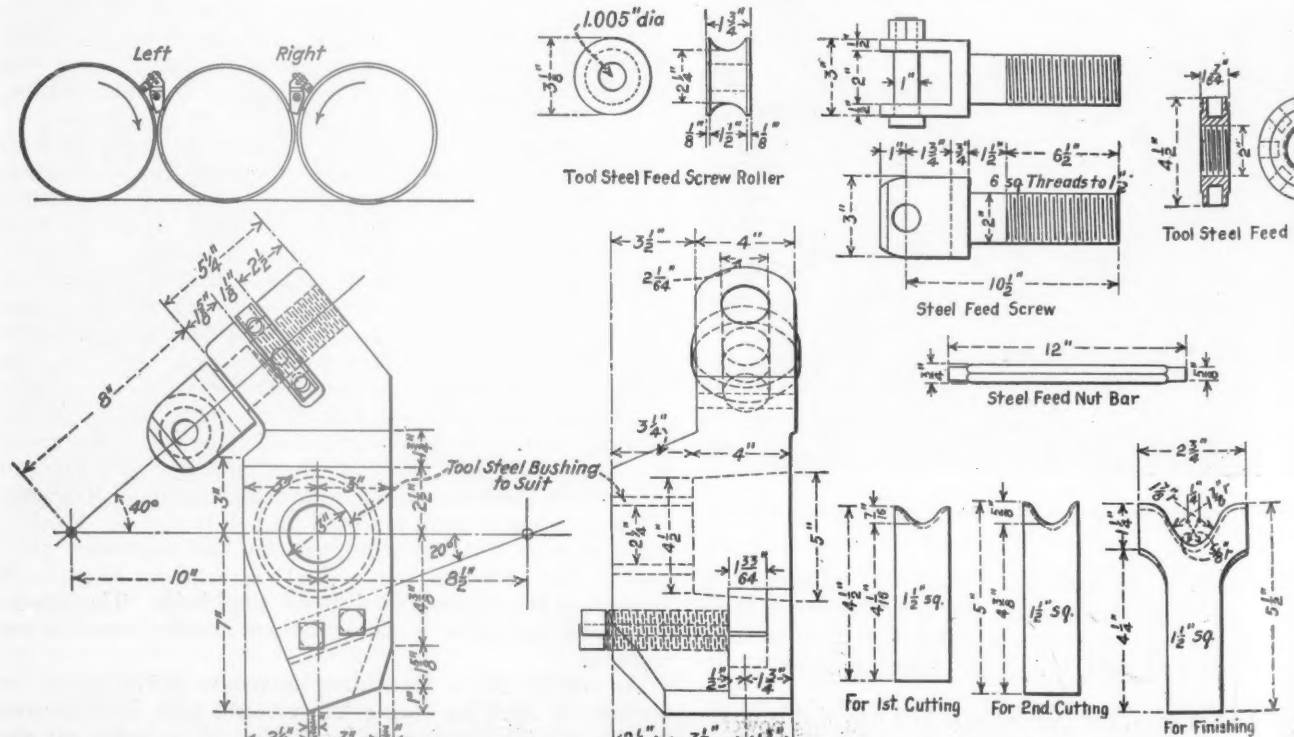


Fig. 8—Portable Tire-Turning Tool for Cutting Down Flanges to the Proper Height without Unwheeling Locomotives

of eccentric keyways before wheels are placed under the locomotive is illustrated in Fig. 9. The standard practice at the Sacramento shops is to apply eccentric keyways before the wheels are placed under the locomotive, thereby saving from eight to twelve hours of locomotive shop time. The device consists of a metal framework cut out as shown to be applied over the largest crank pin. A spirit level *L* is applied to the top of the frame, an adjustable pointer *D* being provided at the bottom. Two bearing pieces, *B* and *C*, are attached to the frame, being accurately machined to form an equal angle with the center line of the pointer and level. In using this jig the axle center is filled with babbitt or soft metal and the center accurately located in the usual manner and prick punched. The jig is applied over the crank pin and pointer *P* adjusted to the center point. The wheels are then rotated until the spirit level shows that the center of the crank pin and axle center are in the same vertical line.

A portable axle keyway milling machine is also used at Sacramento shops, being rigidly held in the correct position on the axle by two straps and a large adjusting screw at the bottom. Power is applied to a spindle and milling cutter by an air motor through a suitable worm and gear arrangement. Hand feed in two directions is provided, one parallel with the axle in accordance with the length of the eccentric keyway and the other at right angles to this motion to give the proper depth required. The device is rigid and produces

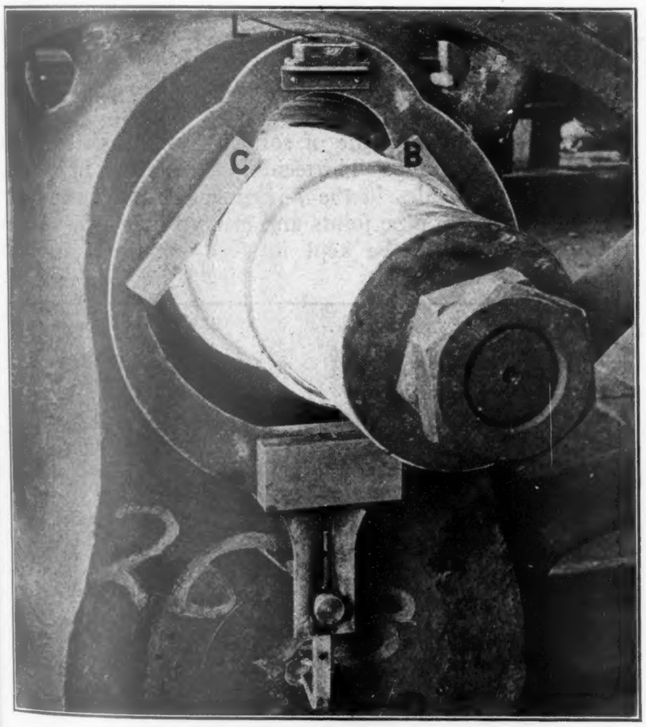


Fig. 9—Jig for Plumbing Crank Pins when Laying Out Eccentric Keyways

an accurate job in considerably less time than could be accomplished by drilling, chipping and filing.

A shrinkage gage for locomotive driving wheel tires has also been made and greatly improved the work of fitting tires to wheel centers, practically eliminating trouble due to loose tires. This gage does not differ greatly from the usual types of shrinkage gages and consists of a 7/16-in. rod of the required length, with a taper hardened point on one end and a micrometer head provided with a taper hardened point on the other end. A solid lock nut holds the adjustment while making a reading. The shrinkage allowed for different sizes of tires, ranging in size from 45-in. to 84-in., is shown in the accompanying table.

Table Showing Allowances for Tire Shrinkage

Outside diameter of tire	Diameter to bore tires	Diameter of wheel centers	Shrinkage allowed
45 in.	37.9603 in.	38 in.	.0397 in.
51 in.	43.9505 in.	44 in.	.0495 in.
55 in.	47.9439 in.	48 in.	.0561 in.
57 in.	49.9406 in.	50 in.	.0594 in.
63 in.	55.9308 in.	56 in.	.0692 in.
69 in.	61.9209 in.	62 in.	.0791 in.
73 in.	65.9144 in.	66 in.	.0856 in.
77 in.	69.9078 in.	70 in.	.0922 in.
79 in.	71.9045 in.	72 in.	.0955 in.
81 in.	73.9012 in.	74 in.	.0988 in.
84 in.	77.8947 in.	78 in.	.1053 in.

Considerable difficulty is experienced when exhaust nozzles are not an accurate fit on the cylinders and allow exhaust steam to blow through and possibly cut the steam pipes or other parts in the front end. If exhaust nozzles are scraped

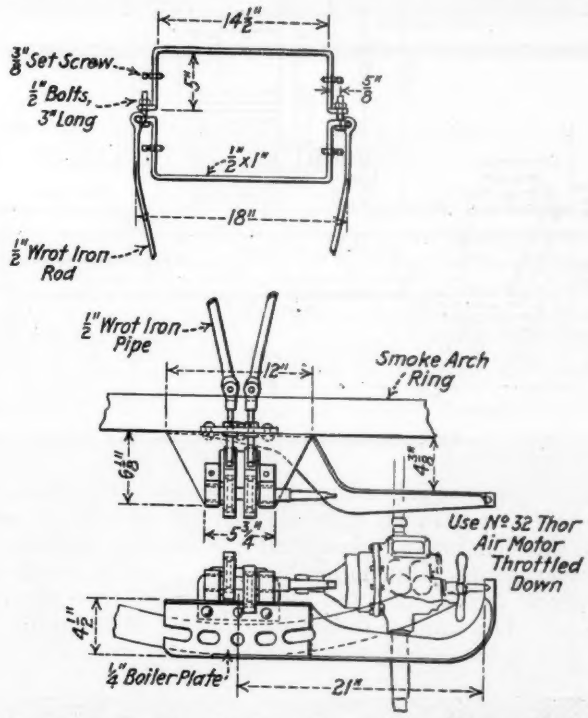


Fig. 10—Device for Grinding Locomotive Exhaust Nozzles

to a bearing on the cylinder, considerable time is required and the ordinary method of grinding joints would be so laborious with a heavy exhaust nozzle as to be practically out of the question. The operation of grinding exhaust nozzles can be greatly facilitated by means of a device, of which a general idea is given in Fig. 10. A framework, supporting a driving motor and two eccentrics, is attached to the smoke box ring as shown. Two arms, adjustable in length to suit different types of locomotives, are attached, one to each eccentric and to a bracket arranged to be clamped around the exhaust nozzle. The eccentrics are set 180 deg. apart and it is obvious that operation of the air motor and eccentric shafts will give the framework and exhaust base a semi-revolving motion. If oil and abrasive are applied between the exhaust nozzle and the cylinder, this motion will soon wear down the high points and bring the nozzle to a suitable bearing.

One of the things which hampers erecting shop work greatly is the absence of necessary air pressure when needed for heavy riveting operations, or when driving out frame bolts. There are many air operated devices in the average railroad shop and when these all work at the same time, it frequently happens that the air pressure on the shop line is reduced below the point at which pneumatic tools operate efficiently. To overcome this difficulty a portable air compressor has been developed, as shown in Fig. 11. This device consists of a Westinghouse 9½-in. air compressor, mounted on a strong, but easily portable four-wheel truck. The air

cylinder of this compressor is bushed to 6½ in. in diameter and air is supplied from the shop line to both the steam and air inlets, air coming through a suitable connection to the shop line. The amount of pressure obtained with this air compressor will depend on the pressure of the shop line, but, in any case, bushing the air cylinder and piping the air supply to both the steam and air inlets will give a pressure sufficiently high to satisfy all needs. Normally, it is possible to get 250 lb. per sq. in. pressure and the governor is set to stop the compressor when that pressure is reached. A reservoir 26 in. in diameter by 36 in. long is clamped to the truck and receives the air as it comes from the compressor. The caution should be observed of carefully testing this reservoir before use to make sure that it will not fail. This portable compressor is comparatively inexpensive to make and being easily portable to any point in the shop, forms a ready means of supplying air wherever a pressure exceeding that of the shop lines is needed.

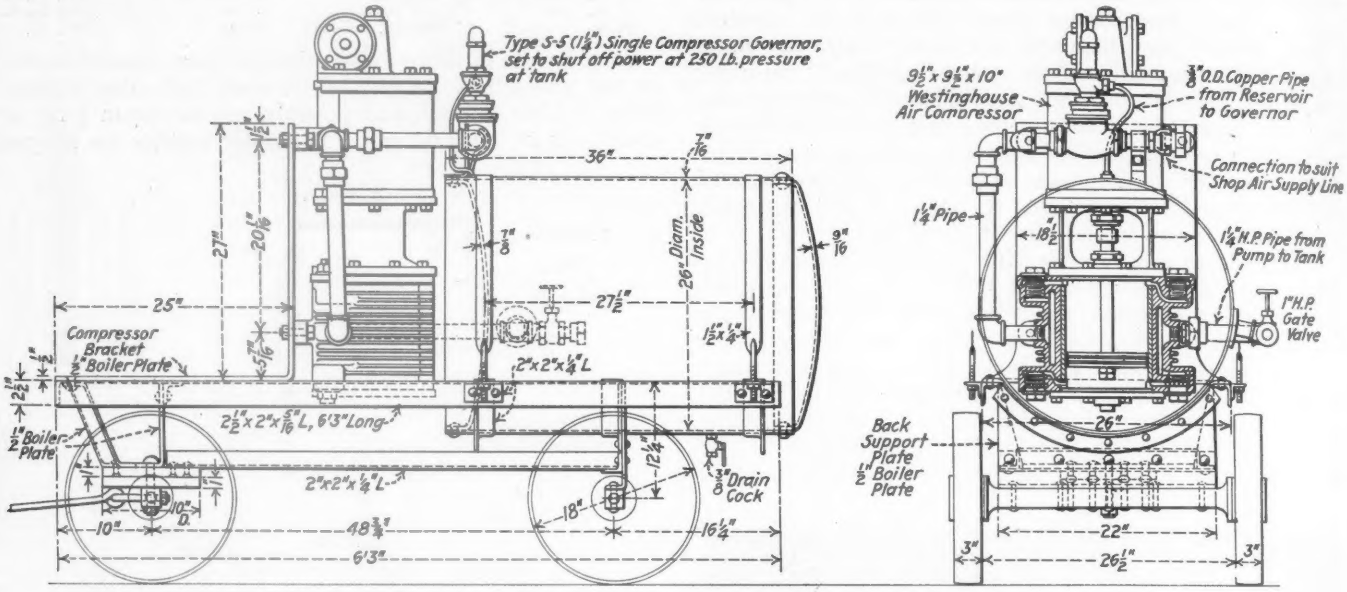


Fig. 11—Portable Air Compressor Gives the Added Pressure Needed in Driving Out Bolts and on Heavy Riveting Work

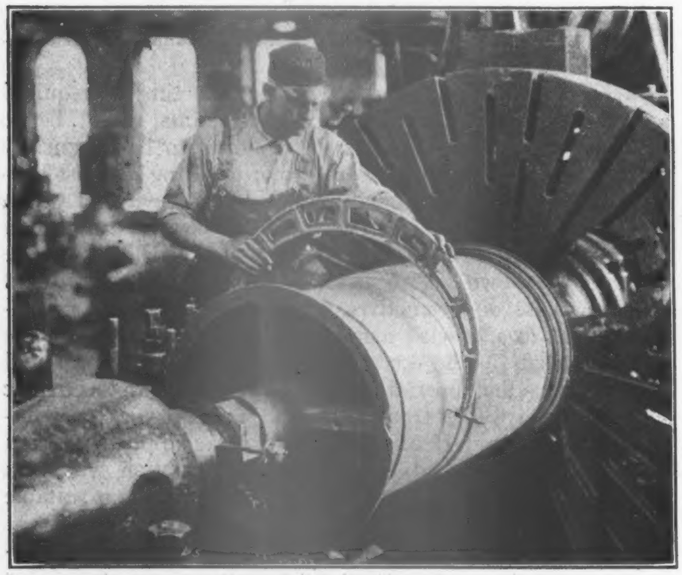


Fig. 12—Shop-Made Micrometer in Use Callpering Cylinder Bushing

An interesting shop-made micrometer for large work is illustrated in Fig. 12. The framework is of aluminum with a micrometer anvil attached to one side and micrometer head to the other. The particular job, shown in the illustration is turning a cylinder bushing to fit a cylinder and the operator is making the allowance for shrinkage, the cylinder size being accurately determined by means of the micrometer.

The ball joint reamers, illustrated in Fig. 13, are made with 5-in. and 7-in. radius, inserted, high-speed steel blades. A No. 5 Morse taper shank is provided in each case. The body of the tools are made of soft steel, the inserted blades being held by caulking. Thirteen blades are used in the 5-in. reamer and 17 blades in the 7-in. reamer, both reamers being used for steam pipe joints and general use. They enable steam pipe joints to be kept in good condition and thus largely reduce troubles from steam leaks at these important joints.

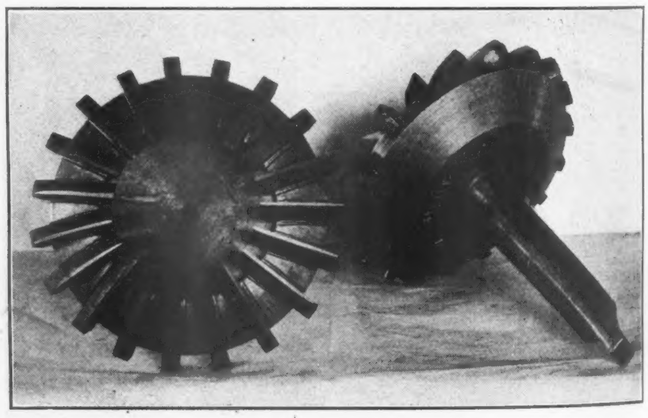
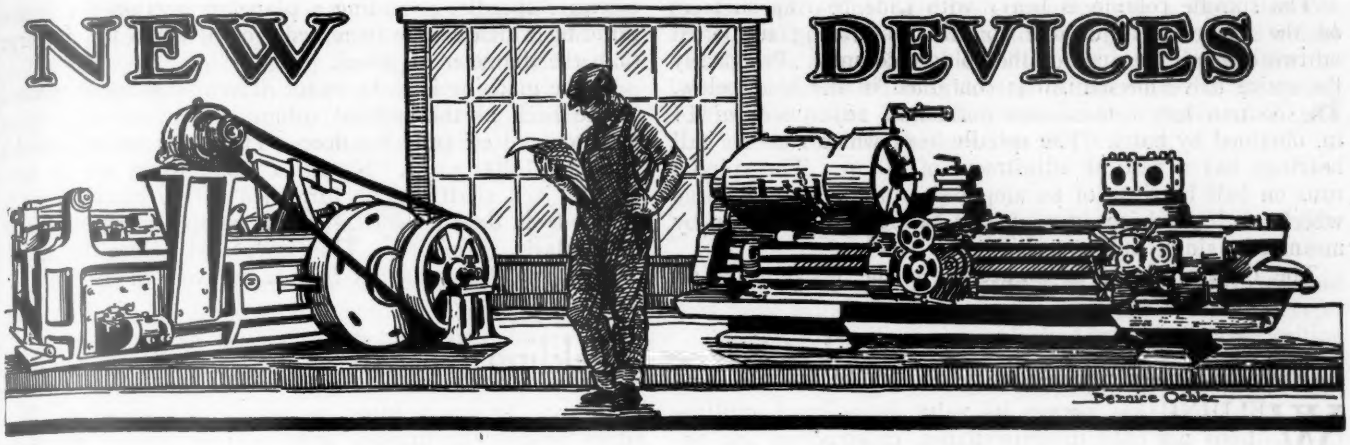


Fig. 13—Ball Joint Reamers with Inserted High Speed Steel Blades

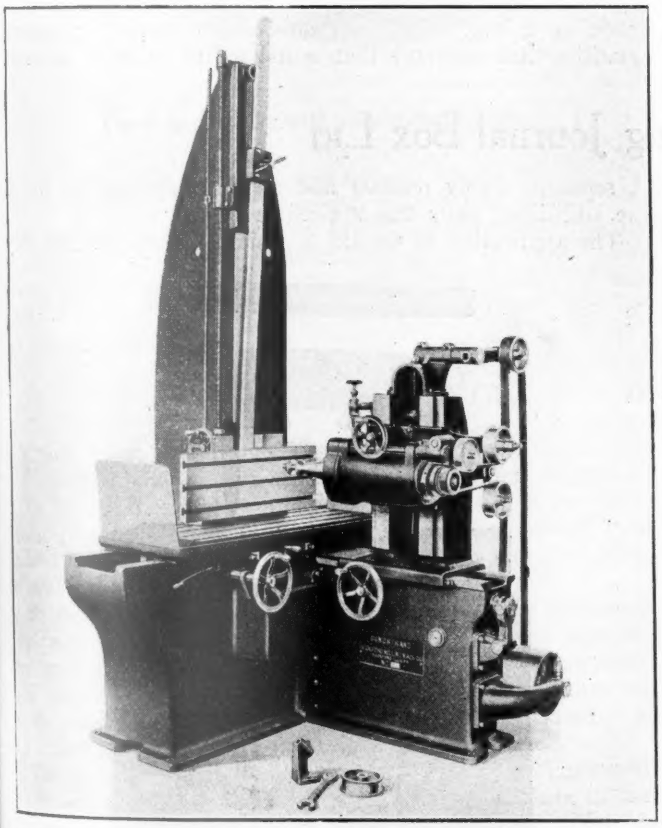
These various time-saving devices are in daily use in the Sacramento erecting shop and there must be further developments along this line both at Sacramento and other railroad shops if the large modern locomotives are to be properly maintained.

Pullman in the Movies.—A motion picture has been made by the Pullman Company comparing traveling in 1859 and in 1923. The film shows the first Pullman car with passengers wearing costumes of pre-Civil War times and illustrates in part the construction of sleeping cars. The picture is designed to inform people regarding the methods employed by the Pullman Company and to illustrate the safety and comfort of travel today.



Sundstrand Radius, Internal and Surface Grinder

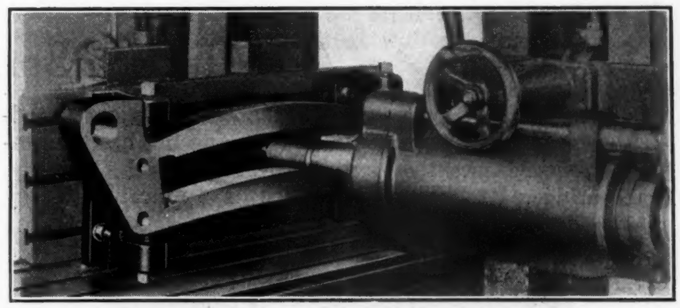
An entirely new design of grinding machine, called the Sundstrand, has been brought out by the Rockford Milling Machine Company, Rockford, Ill. It not only is a highly satisfactory radius link grinder, but because it is so easily converted to internal and surface grinding, its adaptability in the railroad shop is practically unlimited. By the use of a vertical radius bar a compact design was secured. Its advantages over the old horizontal type, which necessarily occupies so much valuable floor space, can readily be seen.



General View of Sundstrand Combination Radius, Internal and Surface Grinder

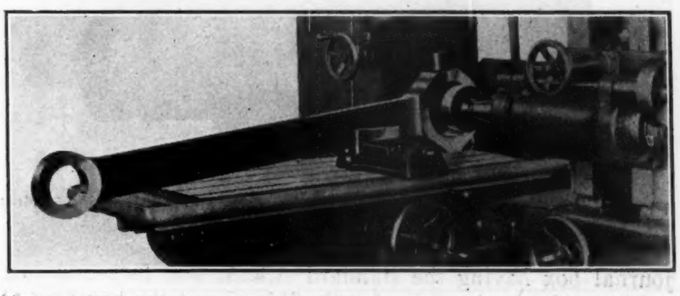
The Sundstrand grinder has a capacity for grinding radii from 18 in. to 100 in. The vertical pendulum motion is entirely independent from the rest of the machine and when not required, can be detached or the radius bar can be swung out of the way. The additional advantages of a horizontal surface or internal grinder, are thus always available.

It is provided with the standard spindle for radius link grinding and light surface grinding. For internal grinding of holes a planetary motion to the spindle is obtained through gearing, easily adjustable in the spindle head while in motion. The spindle head is also arranged for an oscillating motion. For heavy surface grinding, the standard spindle can be removed and another used in its place, designed for that purpose alone.



Radius Grinding Link Using Oscillating Movement to Heavy Surface Grinding Spindle

The base is made of two heavy castings, well ribbed and provided with wide bearing surfaces for the horizontal table and spindle column. The castings are firmly secured at right angles, insuring exact alinement at all times for the spindle and vertical table. To the back of the base is bolted the vertical column for the radius bar and this column also serves as the motor bracket when the machine is arranged for motor drive.



Grinding Hole in Side Rod Using Standard Spindle with Planetary Motion

When radius grinding, the work is held to the vertical table, which is secured to the radius bar. This table measures 12 in. by 36 in., and is controlled in its reciprocal motion by the horizontal table which measures 16 in. by 48 in. An automatic longitudinal feed of 50 in. is provided with either hand or power feed in either direction.

The spindle column is heavy with wide bearing surfaces on the base, the adjustable spindle head being supported on two dovetail bearings on the spindle column. Practically the entire drive mechanism is contained in the base below. The column has a maximum horizontal adjustment of 14 in. obtained by hand. The spindle head which runs on ball bearings has a vertical adjustment of 20 in. The spindle runs on ball bearings of an ample size to take care of large wheels and provision is made for taking up the wear by means of a single nut.

The driving sleeve is connected in the housing by an eccentric spindle, providing a planetary motion for internal grinding which can be increased from 0 in. to 1¾ in. larger than the diameter of wheel.

If the machine is to be motor driven, a motor is mounted at the back of the vertical column out of the way of the operator and off from the floor. The motor recommended is 7½ hp., 1,200 r.p.m. Should a motor drive not be desirable, a jack shaft can be furnished or the machine can be driven from the line shaft. An oil pump for cutting coolant is regularly furnished. This is located below the spindle column and draws coolant from a reservoir in the base.

A High Carbon Welding Metal

WELDING has proven its value in railroad applications not only in maintenance, construction and repairs but also as a reclamation medium particularly on low carbon steel parts. The reclaiming and maintenance of high carbon steel parts such as buffer castings, frog points, steel tires, etc., have somewhat suffered due to the fact that a suitable welding metal was not generally available.

The Page Steel & Wire Company, Bridgeport, Conn., has perfected a welding metal, the carbon analysis of which is practically 1.00 per cent, for welding high carbon parts by either the oxyacetylene or electric arc welding process.

The principal application of Page high carbon welding rods and electrodes is for the building up of worn surfaces where a high resistance to abrasive wear is desired. In electric arc welding this electrode maintains a stable and uniform arc. In gas welding the metal flows smoothly. With either process the finished weld may be ground but is not readily machinable.

Tests of Weld Deposits on .42 Carbon Steel

Original metal—		
Carbon		.42
Scleroscope		35.
Two layers of weld metal—		
Outer surface of deposit	.63	38
At a depth of 1/16 in. from top	.56	37
At a depth of 1/8 in. from top	.57	33
At a depth of 3/16 in. from top	.46	34

The table shows a typical result of weld deposits when made on a steel of .42 carbon content indicating wearing qualities that are more than equal to the original material.

Asco Torsion Spring Journal Box Lid

A NEW type of journal box lid, known as the Asco hoodless torsion type roller bearing spring lid, has been introduced recently by the Allegheny Steel Company, Brackenridge, Pa. This lid, which is applicable to any journal box having the standard A.R.A. box face and lug, possesses the merit of forcing the lid against the box face at the top as well as at the bottom.

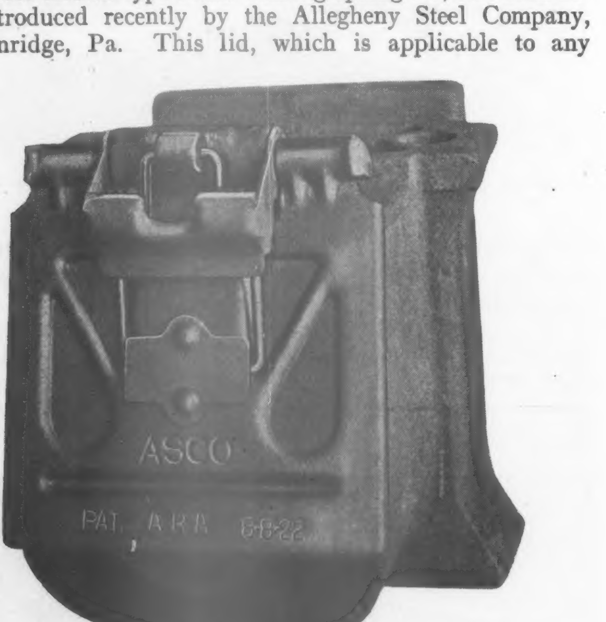


Fig. 1.—Journal Box with Asco Torsion Type Roller Bearing Spring Lid

The lid body is pressed from ⅛ in. steel plate with side and bottom flanges and an integral turn-down scroll. It is stiffened by special embossing and as a result of the design is of light weight. The torsion spring with its roller is attached to the pressed steel lid as shown in the illustrations. A separate spring retainer and a pin completes the list of the additional parts that are required.

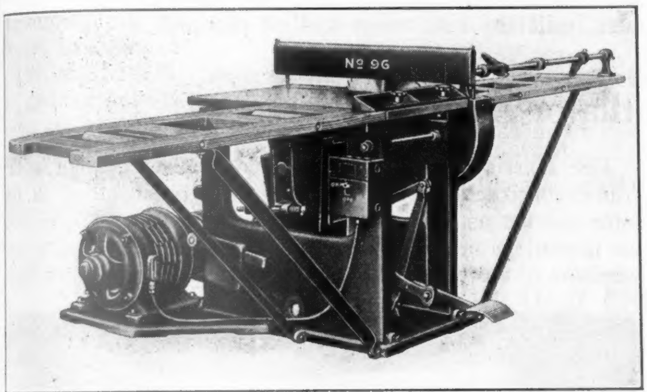
The application of the lid is a simple operation and may be performed by one man in a moment or two without any fitting, provided the box has an opening with a flat bearing surface and a box lug which approximates the A.R.A. di-

Fig. 2.—Asco Lid with Attached Roller Bearing Spring; also Separate Spring Retainer and Pin

mensions. All that is necessary is to lay the lid on the box face, hold the spring retainer in position, insert the headless pin and hammer down the right hand scroll which positively locks the lid body, spring retainer and pin. The spring retainer is then snapped into its locked position by a short pinch bar inserted between the spring roller and the retainer. The only tools required are a light hammer and a small pinch bar. This lid not only reduces the weight and insures a strong and even bearing pressure between the lid on the box on all four sides of the opening, but the spring action does away with all strain on the scrolls of the lid and also overcomes the wear on the box lug.

High Speed Under-Swing Cut-off Saw

As a rule swing cut-off saws are suspended either from the wall or ceiling and something new along this line is now offered in the No. 96 high speed under-swing cut-off saw illustrated. Made by the Oliver Machinery Company, Grand Rapids, Mich., this saw is designed for either belt or motor drive, being operated by means of the foot treadle at the front. By pressing on this foot treadle, the saw itself is brought forward to cut off 2-in. material up to 22 in. wide, or 4-in. material up to 16 in. wide. The instant the pressure is relieved from the foot treadle, the saw goes back, there being a spring in connection with the foot treadle arrangement to give the saw a quick return so that it is more rapid in operation than the usual overhead type.



Oliver No. 96 Under-Swing Cut-Off Saw

The saw arbor itself can be locked in a stationary position so that it can be used as a rip saw. Using the miter gage, it will serve like the ordinary stationary arbor cut-off saw. These are adaptations, however, as the machine itself is most efficient as an under-swing cut-off saw. For ripping and miter gage work, it is accurate enough for the ordinary contractor and builder but it is not recommended for ripping and miter work in a pattern shop. It does not take the place of the universal and variety saw bench in a practical way but it is useful and strongly recommended for cutting off lumber as it comes from lumber racks or piles.

The machine is guarded with an adjustable saw guard and has an enclosed saw and dust chute. Both of the operator's hands are free to handle the material being cut, making for efficiency and not tiring the operator as much as the hand-pull saw. This machine is self-oiling and powerful.

The main part of the table is of cast-iron 22 in. by 36 in. long and 33 in. high. The two auxiliary tables or extensions are of hard maple and are fitted with two rollers each. The right-hand section is fitted with a positive stop gage having three adjustable stops.

The forward and back stroke of the saw arbor is adjustable for short or long strokes and the spring mechanism mentioned above prevents jerking and jarring on both forward and return travel of the saw. For belt drive, a countershaft is provided and for motor drive an extended sole plate is furnished in place of the countershaft.

A New Pratt & Whitney 16-Inch Lathe

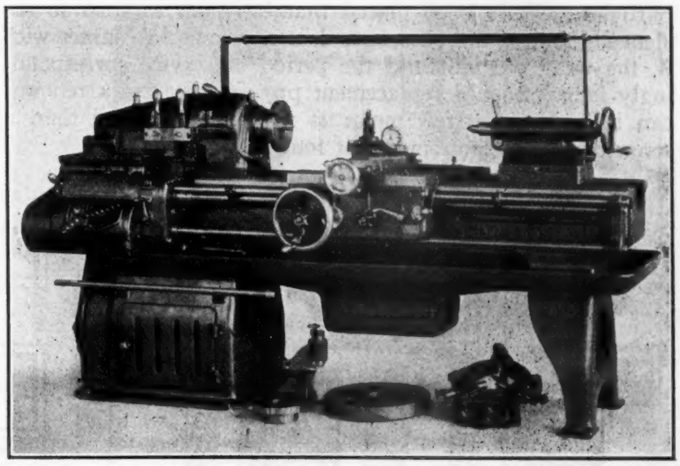
The Pratt & Whitney Company, Hartford, Conn., has brought out a new design of 16-in. lathe, known as Model B, suitable either for toolroom use or for high-speed production work. This lathe is offered either with geared head, for drive by independent motor or single pulley, or with cone pulley head.

By mounting the back gears below the spindle overhanging parts are eliminated, the headstock is centered over the bed and the operator is given greater freedom of movement and uninterrupted light on the work. The back gears are easily engaged from the front of the machine by means of an eccentric lever located under the spindle nose.

The sliding speed change gears, of chrome-vanadium steel, hardened, are fully enclosed and splash oiled and are shifted by two convenient levers on the front of the head. The interlock between the levers is controlled by the stop and start lever at the rear. Eight spindle speeds, ranging from 13 to 525, are provided.

The individual motor drive is compact and equipped with push button control located on the front of the headstock. The motor, which is 5 hp. A. C. or D. C., constant speed, 1,160 r.p.m. is mounted within the cabinet and connects by belt to the main drive pulley. For single pulley, the drive is through guarded pulley at the rear. Eight spindle speeds ranging from 13 to 525 are provided. The cone head has a solid housing and the same back gears as the geared head. A hand brake adds to safety and speed of operation. Spindle speeds range from 9 to 530.

The positions of the ratio lever and rocker arm for any desired feed or thread are instantly located by a large, direct reading index plate mounted on the quick-change gear box.



Pratt & Whitney 16-In. Lathe, Model B, for Tool Room or Production Work

The operator simply moves the ratio lever into position at the end of the proper horizontal line of threads, or feeds on the plate, and sets the rocker arm below the particular one desired. This device permits rapid setting and checking of the feed in use and makes the gear box practically fool proof.

The compound rest hand wheel is set at an angle of 20 deg. above its screw. This allows plenty of hand room and provides space for a large dial graduated in half thousandths to conform to micrometer readings.

Quick withdrawal for thread cutting is accomplished through the regular hand wheel by means of a coarse threaded sleeve on its hub. The compound rest screw is used for feeding, so that after starting the thread neither the feed, depth of cut nor stop needs any special attention. The lever operating the combined stop and reverse rod is at the right end of the apron. This rod is located above the lead screw, thus protecting the latter from damage and permitting the operator to set the carriage stops without stooping or taking his eyes from the work. Fine adjustment is obtained by a micrometer sleeve. For fine threading the hand wheel may be disengaged from the rack pinion. A simple thread chasing dial is made a part of the apron. The apron is also equipped with the usual knob for power cross feed and lever for engaging the screw. Longitudinal and cross feeds range from .0012 in. to .0665 in. For threading, 36 pitches are provided, the range being from $1\frac{1}{2}$ to 80 threads per inch.

The tailstock has a long, solid barrel and a large graduated spindle. This spindle is locked by a long wedge on its lower side in such a way that no loss of accuracy can occur from the locking strain. The tailstock is clamped to the bed by an eccentric shaft parallel to the spindle and the same handle provides a means of moving the tailstock along the bed. The usual cross adjustment is provided.

Various special equipment can be supplied, including taper attachment, elevating tool rest, ball turning, collet attachment, relieving attachment and oil pump.

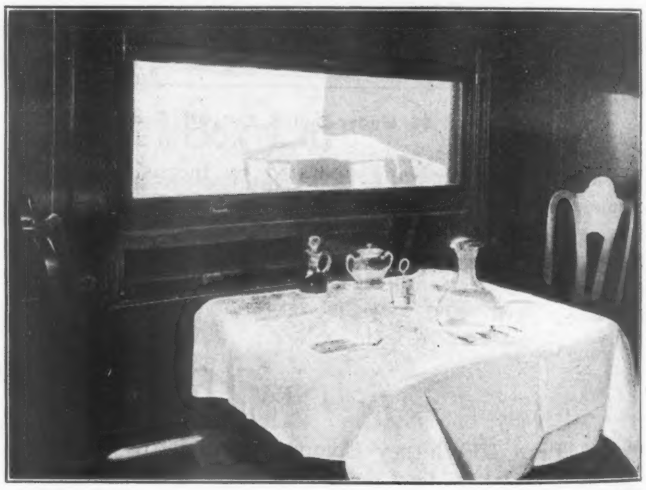
Harrison Ventilator Sash

THE Combination Ventilator Company, Richmond, Va., is introducing a novel ventilator for the sash of passenger coaches which is the design of Charles L. Harrison. The primary purpose of the Harrison ventilator, which is an integral part of the sash itself, is to provide the maximum of clean, fresh air to travelers in railway passenger cars of all types, and in such a manner that the amount can be increased or reduced at the will of the individual passenger without interference with the ventilation desired by other passengers in the same car. The control is by means of a hinged shutter that can be operated without effort and without arising from the seat.

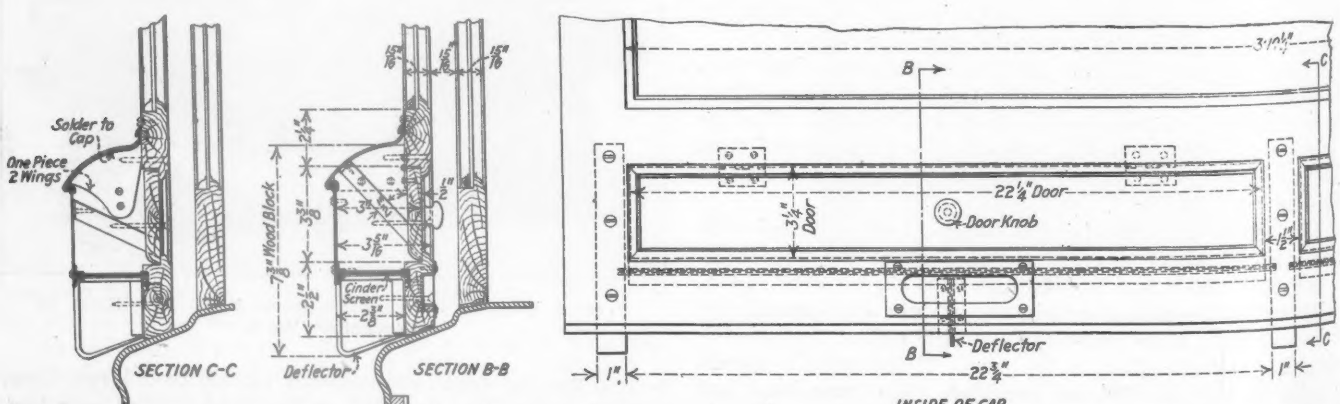
Referring to the drawing, it will be noted that the ventilator is of simple construction, compact and durable, the only moving parts being the control shutter. A slight pressure or pull applied to the knob on the shutter will adjust and lock it in any desired position.

The opening of the sash is fitted with a small removable screen horizontally placed. This screen is made of brass wire, 0.015 in. in diameter, with 22 meshes per inch, and gives a free opening of 45 per cent of the area. This netting opening is $1\frac{1}{2}$ in. wide and practically the full length of the sash. The screen is protected by an outside sheet metal hood and its horizontal position is such that it serves to exclude rain as well as cinders, dust, snow or other flying particles. As it is so placed that it is not exposed to the elements and as the passenger does not come in contact with it, the wear is slight and the period of service correspondingly long. Should replacement prove necessary, a renewal can be made in a few moments with no other tool than a screw driver for the removal of four small screws.

The Harrison ventilator sash requires no change in the frame construction of a car and may be installed in the same manner as the ordinary sash now in use. There being no inward projections, it is adaptable to single or double windows of any size. Where double sash is used, as in Pullman cars, this ventilator sash does not interfere with the raising or lowering of the inner sash. The ventilator projects only $2\frac{1}{4}$ in. beyond the face of the sash which is usually inside the outer line of other projections. It occu-



Interior View of Car with Harrison Sash Ventilator—Left Half Open—Right Half Closed



Construction of Harrison Sash Ventilators as Applied to Dining or Pullman Cars

pies but little more space at the window base than the frame of the ordinary type of sash and eliminates the projecting deflector of the ordinary sash ventilator used on Pullman cars. The small deflector shown in the drawing is employed to divide the air current and thus increase the capacity of the ventilator.

The advantages of a ventilator which will insure an adequate quantity of fresh, clean air and without the sash being raised are numerous and obvious. Among them, the following may be mentioned: The comfort of passengers is increased by the freedom from cinders and dirt. Cars are freer from dirt at the end of a run and require less frequent cleaning.

The air admitted is deflected upward and there is no draft upon passengers. The device does not become useless in stormy weather. It is not necessary to open or close windows in order to secure ventilation or when entering or leaving tunnels. It might even be possible to adopt fixed stationary windows.

The ventilator fixture takes the place of the lower rail of the sash ordinarily used and does not obscure the vision, being an integral part of the sash, there is nothing to remove for cleaning or storage purposes, consequently there is no chance of loss and the risk of damage is likewise materially reduced.

No handling or adjustment is required when the motion of the car is reversed as the ventilator sash operates equally well in whichever direction the car is moving.

Cars standing in yards may be kept fresh through continuous ventilation without the risk of the interior becoming wetted or damaged from sudden rain or wind storms as often occurs when car windows are left open.

The ventilator sash is suitable for washrooms and toilets, offering privacy and convenience and eliminating screen, deflector and roller shades which are not required where this device is installed.

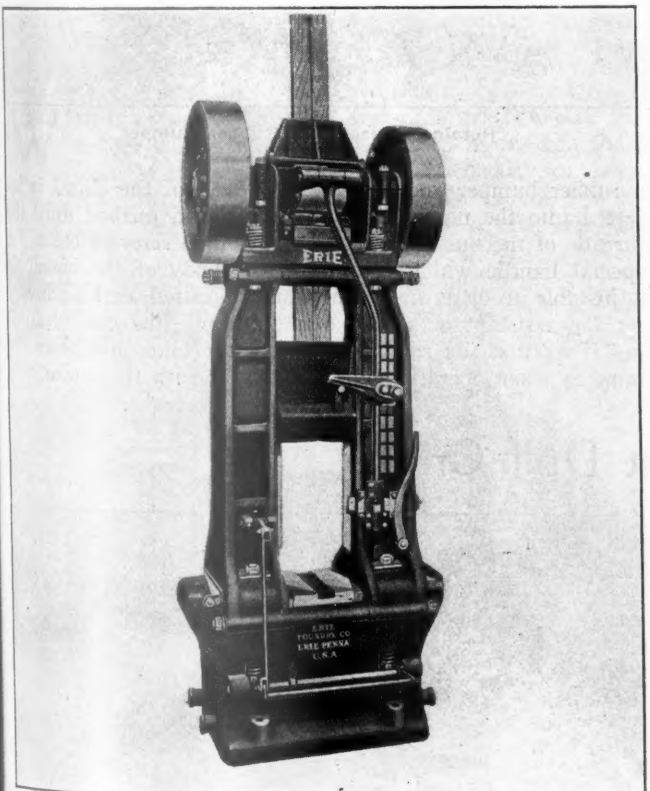
The Harrison ventilating sash has been applied to cars on several roads. Included among the cars thus equipped are a number of dining cars.

Tests that have been conducted have shown that the capacity of the ventilators, all being open, and the car running at a speed of at least 25 miles an hour, is sufficient to effect a complete change of the air contained in the coach in from one to two minutes and that the freedom from dirt and cinders is noticeable.

While designed for use on passenger coaches, the Harrison ventilator sash would be equally effective and advantageous in postal, express or electric cars. They furthermore could be adapted readily for use in windows of offices, hotels or other buildings.

High Production Board Drop Hammers

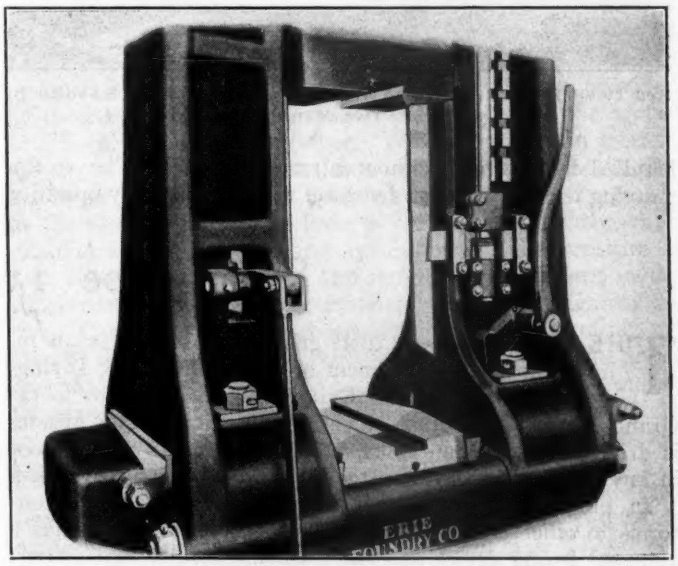
THE Erie Foundry Company, Erie, Pa., has brought out a new line of board drop hammers, characterized by a refinement of detail rather than by any radical departure from accepted principles of construction. Many ideas



Erie Board Drop Hammer, Made in Sizes from 200 Lb. to 4,000 Lb., Inclusive

developed by actual forge shop experience and now considered as standard in heavy steam drop hammer construction have been adapted to the new line of board drop hammers. A thorough study has been made of the troubles experienced with existing types and practical drop forgers consulted as to the best methods of correcting these faults, the idea of the builders being to achieve a machine capable of a high-rate of production at a minimum of operation and maintenance expense, and dependable even under the severe conditions to which drop hammers are subjected.

Among the outstanding features of the new hammers are wedge adjustment of the frames across the anvil, the use of tie bolts and separators between the frames at the bottom and a new type of latch. The wedges hold the frames and anvil together as a solid unit, making it easy to maintain the aline-



Close-up View Showing Drop Hammer Latch

ment of dies and at the same time making adjustment easier. The use of wedges and the design of the tongue and groove construction between frames and anvil prevents scale from working into this joint and increasing wear.

Another factor tending to maintain the alinement of the whole machine is the use of tie bolts and separators between

the frames, top and bottom, front and rear. The separators prevent binding of the ram in the guides and yet minimize the amount of play. Their length can be reduced to compensate for wear of the guides or planing down.

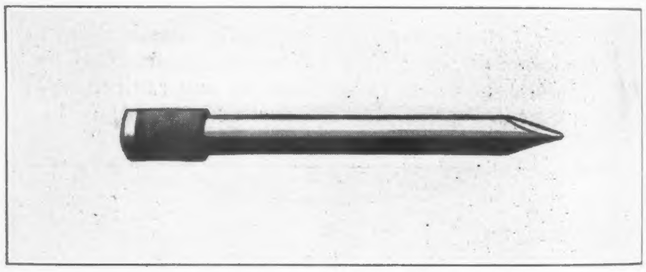
The new type Erie hammer has a greatly increased tongue and groove area; also several details of the operating mechanism have been improved. The point of knock-off is easily adjusted, assuring that adjustment will be made as often as desirable and that the rolls will grip the board at just the proper moment. The friction bar drops vertically in guides, the latch bar being moved by the descending ram from under a block which fits against a shoulder on the bar. As the ram ascends, a hickory pin strikes one end of the roll release lever which is pivoted on a block clamped to the friction bar. Thus the friction bar is lifted gradually and without shock. The other end of the roll release lever bears on a pin which is adjustable up and down on a rack cast on the frame by means of which the length of strokes is varied. The crosshead construction used at this point reduces wear and shock.

The ram is an open-hearth steel casting, cast by a special process to assure a dense structure of clean metal. The main bearings are bushed with phosphor bronze, and ample bearing area is provided. The anvils can be furnished in the ratio of 15 to 1 or of 20 to 1 to the weight of ram. The pulleys can be of wood, paper, or steel, to suit individual requirements. The new line of Erie hammers is built in sizes from 200 lb. to 4,000 lb. weight of falling parts.

"Red Devil" Two-Man Rivet Cutter

IMPROVEMENTS recently made by the Rice Manufacturing Company, Indianapolis, Ind., make it possible for the Red Devil rivet cutter to be handled successfully by two men. It has been found that a rivet cutter cannot be handled by two men without a retainer chisel. The accompanying illustration shows a chisel which is made by upsetting a flange on the head end, with the body or shaft of the chisel of a uniform diameter without any shoulder all the way down to the cutting end; the cutting end is shaped so that a rubber bumper can be slipped over the cutting end and pushed back to the flange on the other end, then the bushing in the nose piece of the rivet cutter can be taken out and slipped over the cutting end of the chisel, with the threads pointing toward the head of the chisel and pushed back against the rubber bumper. After assembling the chisel with a rubber bumper and bushing, the head of the chisel is inserted into the nose piece of the gun, and pushed until the threads of the bushing engage and is then screwed home. A special handle which clamps on the body of the barrel, is adjustable up or down to any position desired, making it easy for the assistant or second man to handle the gun in guiding it against the rivet. The operator takes his place the same as when operating the rivet cutter with three men.

Red Devil Rivet Cutter with Retainer Chisel Can Be Handled by Two Men

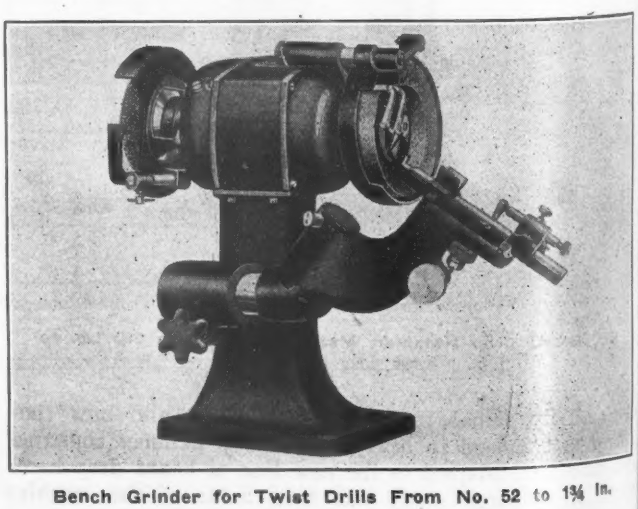


Retainer Chisel with Rubber Bumper

Bench-Type Twist Drill Grinder

THE bench-type twist drill grinder illustrated is an interesting new development of the Gallmeyer & Livingston Company, Grand Rapids, Mich., successor to the Grand Rapids Grinding Machine Company. The grinder is driven by a self-contained motor, enabling it to be placed in any position in the shop toolroom where most convenient.

In the basic principles of design and operation it conforms to other Grand Rapids twist drill grinders. It has a diamond truing device and the diamond is furnished as part of standard equipment for dressing the wheel. The holder is automatically placed in the right relationship with the grinding wheel so that it is close enough to grind the drills accurately and at the same time, the stop makes it impossible to bump the front of the holder into the grinding wheel. The machine illustrated is the A-7-T type with a capacity for drills from No. 52 to 3/4 in. It is also made with a drill holder having a capacity of from 1/8 in. to 1 1/2 in. drills, in which case it is designated style B-7-T.



Bench Grinder for Twist Drills From No. 52 to 1 3/4 In.

These machines are each equipped with a ½-hp. motor and can be driven from the lighting circuit or power lines, the motors being either a.c. or d.c., single-phase or polyphase, as may be desired.

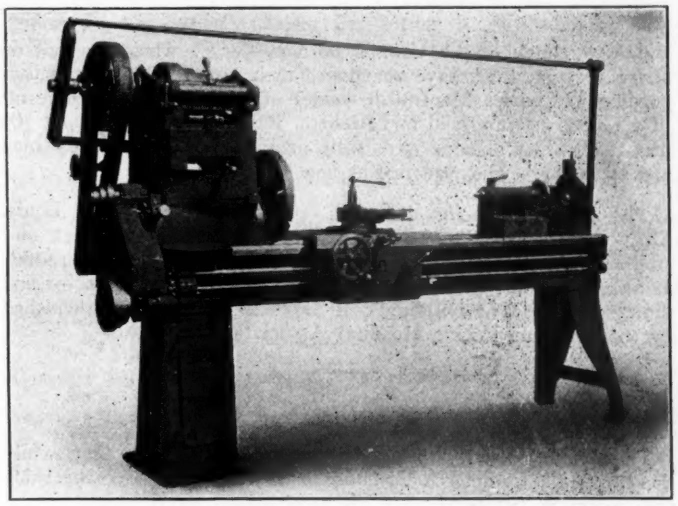
The motor bearings are especially designed and manufactured for this particular machine so as to provide conveniently for adjustment to take up either radial or end wear, and so as to eliminate end play, which is prohibitive in drill grinders. The swivel bearings are of bronze-bushed type, turning on a ground steel stud, with a complete protection from dust and convenient means for clean lubrication which adds greatly to the durability.

Motor Drive Arrangement for Engine Lathes

In order to meet the demand for motor-driven lathes, the John Steptoe Company, Cincinnati, Ohio, has recently designed a compact motor drive arrangement which is applicable to its 14-in., 16-in., 18-in. and 20-in. lathes. This motor-drive arrangement can be readily attached to the lathes in the field, as very little machine work is required with the exception of drilling and tapping a few small bolt holes.

The countershaft unit is bolted over the lathe cone pulley, and is provided with a clutch gear so that the motor can be engaged and disengaged instantly. The countershaft cone pulley can be moved away from the lathe spindle for tightening the belt and the belt from the motor to the countershaft is always kept tight by means of an idler pulley. The motor is placed directly behind the lathe in line with the bed, and is so located that there is no vibration to the lathe. A constant speed motor, running at 1,100 to 1,200 r.p.m. is recommended.

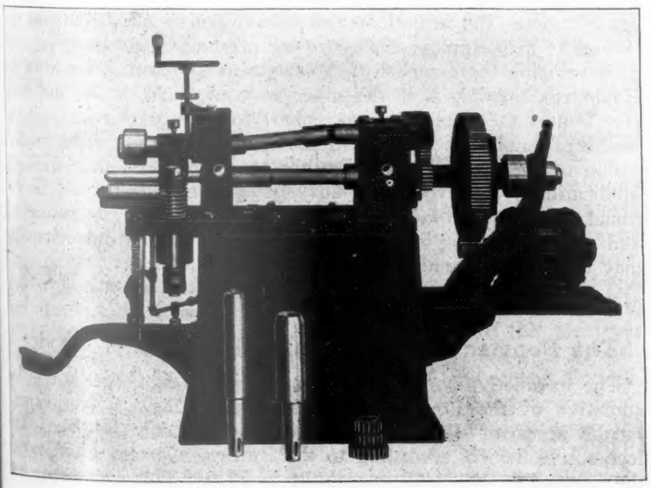
The Steptoe standard engine lathe, equipped with motor drive, is a conveniently-operated production unit for lathe operations within the capacity of the machine. It is adaptable to use in railroad machine shops and toolrooms where the electric drive feature will prove particularly valuable in enabling the lathe to be placed in the most advantageous position, irrespective of the location of line shafting.



Motor Drive Applied to Headstock of Steptoe Engine Lathe

A Roller Type Flue Welder

What is known as the Marshalltown-Schaefer flue welder has recently been developed by the Marshalltown Manufacturing Company, Marshalltown, Iowa. A distinctive feature of this welder is the use of two revolving rolls, one inside and one outside of the flue, between which the weld is made. These two rolls are power driven at a comparatively slow speed and are connected by gears, the ratio of which causes both rolls to operate at the same circumferential speed.



The Marshalltown-Schaefer Flue Welder

The illustration shows the welding machine alone. With it, however, are furnished a 350-lb. anvil with a cone-shaped horn for belling the ends of the flues preparatory to receiving the safe ends, and a ball and roller bearing stand to support the outer ends of the tubes while in the welding machine. After the tube has been prepared to receive the safe end and heated with the safe end in place, the weld is made on the machine by slipping the heated flue and safe end over the lower mandrel or inside roller and bringing the weld under the upper or outside roller. A stop can be provided on the mandrel by placing a short piece of flue of the proper length on the back of the arbor. With the rollers in motion, the upper roller is brought down in contact with the flue by means of an air cylinder operated by the foot lever shown in the photograph. This lever is first pressed lightly while the flue makes two or three revolutions. The pressure is then increased, causing the two rounding rolls shown in the illustration below the inside mandrel, to move up against the flue. Care must then be taken not to continue the rolling too long or the size of the flue may be enlarged. With the roller bearing adjusted so that it is in line with the inside mandrel, the revolving of the flue while the weld is being made aligns the flue and the safe end so that when the weld is complete the whole piece is straight.

The machine has a welding range which will take tubes from 2 to 6 in. in diameter by changing the rolls, and pieces up to 9 in. in length can be welded on the flue. Three sets of rolls are furnished with each machine and a small hand wheel adjustment is provided at the top so that the welding roll may be correctly set about 1 in. above the mandrel in each case.

The Movement of freight, westbound, over the Pittsburgh Division of the Pennsylvania Railroad, on July 3, was the heaviest on record for a single day, 5,091 cars passing Gallitzin. This is 239 more cars than on the heaviest preceding day, which was September 15, 1919.

GENERAL NEWS

A crew of four men built a freight car in the shops of the Texas & Pacific at Marshall, Tex., on July 27, in 5 hr. and 55 min. The crew was one of eight engaged in a contest in building standard 36 ft. stock cars. The maximum time consumed in the contest by four men in building one of the cars was 6 hr. and 40 min.

The shopmen of the Central of New Jersey who went out on strike in July, 1922, have abandoned their strike. This action, according to Charles MacIntosh, leader of the strikers, is the result of a recent meeting held in Elizabeth, N. J., attended by about 100 men. The road's shops were fully manned long ago by new men and by strikers who returned as new men.

The Missouri Pacific dedicated its new hospital at St. Louis, Mo., on July 29. The building is six stories high, of brick and stone construction and contains 300 beds and six operating rooms. It also has ample sun parlors, dressing rooms, serving rooms and dining rooms. The building cost $1,000,000, which was furnished by the Missouri Pacific Hospital Association.

Boiler Inspection Act

The Circuit Court of Appeals, Sixth Circuit, holds that, while the Interstate Commerce Commission is authorized to make rules and orders in furtherance of the enforcement of section 2 of the Boiler Inspection Act, requiring boilers in operation to be in proper condition, the failure of the Commission to make a rule or order covering every defective condition or construction within the meaning of the section does not relieve the railroad from complying with its provisions.—Baltimore & Ohio v. Groeger, 288 Fed. 321.

Locomotive Shipments and Orders on Hand

The following table was prepared by the Department of Commerce showing July shipments of locomotives from the principal manufacturing plants, based on reports received by the Bureau of the Census from the individual establishments:

LOCOMOTIVES

	July, 1923	June, 1923	July, 1922	Seven months' total January to July 1923	Seven months' total January to July 1922
Shipments:					
Domestic	211	221	122	1,543	342
Foreign	28	11	6	101	148
Total	239	232	128	1,644	490
Unfilled orders (end of month):					
Domestic	1,652	1,854	712	...	...
Foreign	86	104	99	...	...
Total	1,738	1,958	811	...	...

Condition of Equipment

Fifty-nine per cent of the locomotives inspected by the Bureau of Locomotive Inspection of the Interstate Commerce Commission during the month of July were found defective, according to the monthly report of the commission on the condition of railroad equipment. The number inspected was 5,197, of which 3,077 were reported as defective; and 568 were ordered out of service. The percentage found defective compares with 61½ per cent during the first six months of 1923, and 68½ per cent during the last six months of 1922. The number of accidents occurring in July and caused by the failure of some part or appurtenance of locomotive or tender, as reported by the carriers, was 115.

The Bureau of Safety reports that it inspected 97,412 freight cars during July, of which 5.2 per cent were found defective and 1,994 passenger cars, of which 1.2 per cent were found defective. For July, 1922, the corresponding percentages were 7.8 and 1.3. During the month of July 109 violations of the safety appliance act were reported for prosecution.

Wage Statistics for May

The Interstate Commerce Commission's summary of monthly reports of employees, service and compensation filed by Class I railroads for the month of May, 1923, shows that the number of employees and the amount of compensation were greater than for any month since the revision of the classification, July 1, 1921. The number of employees reported for May, 1923, shows an increase of 267,991 or 16.5 per cent over the number reported for the same month last year, and an increase of 52,567, or 2.9 per cent over the number reported for April, 1923. The total compensation for May, 1923, was 19.8 per cent greater than in May, 1922, and 5.6 per cent greater than in April, 1923. Compared with the same month last year the average straight time hourly earnings for all employees reported on an hourly basis decreased from 58 to 56 cents, and overtime hourly earnings decreased from 77 to 75 cents. But owing to more regular employment the employees as a whole averaged 222 hours in May, 1923, as against 210 hours in May, 1922, which resulted in an increase in the average monthly earnings from $128 to $132.

A New Department on the Rock Island

A department of personnel and public relations, headed by H. S. Ray, assistant to the president, who now has the title of director of personnel and public relations, has been established on the Chicago, Rock Island & Pacific. The department will function under two divisions. A. B. Ramsdell, assistant vice-president in charge of labor, will be assistant director of personnel and W. E. Babb, editor of the Rock Island Magazine, will be assistant director of public relations. The new department will attend to: Supervision of wages and working conditions; supervision of recreational activities among employees, including social clubs, outings, musical organizations and athletic teams; development of educational activities to help employees prepare for promotion and to assist them in developing their capacity; development of housing facilities for employees, together with the supervision of Y. M. C. A. and other rest houses at terminal points; plans for the improvement of the health of employees and conditions surrounding their work; supervision of the Rock Island Monthly Magazine and other employee publications; supervision of advertising literature of an institutional character; contact with civic and community organizations and with the public, to the end that a better mutual understanding may be developed and maintained.

The Booster Tested in English Passenger Service

The locomotive booster has been applied to an Atlantic type locomotive of the London & North Eastern Railway for experimental purposes—the first booster to be applied in England. The locomotive, which, according to the Railway Gazette (London) is the company's No. 1419, was built in 1910. This locomotive has 20 in. by 24 in. cylinders, is equipped with a superheater and weighs 165,984 lb. in working order, exclusive of the tender. It develops 17,340 lb. tractive force at 85 per cent of boiler pressure without the booster and to this the booster adds another 8,500 lb., giving an increase of almost 50 per cent. The locomotive is in passenger service and it is in this service with an 18-car train that the booster is being tested.

The company has 120 locomotives of this type, the first of which were built in 1902, and all of which have been successful in service.

With the increasing train-load, however, the low tractive force of the type has made their operation increasingly difficult. If the application of the booster is successful in overcoming the difficulties of starting and of operation on heavy grades, it is thought that the period of usefulness of the locomotives may be considerably extended. The application of the booster and the tests are under the supervision of H. N. Gresley, chief mechanical engineer of the company.

Tank Car Specifications

The general committee of the A. R. A. has announced that at the request of certain owners and upon recommendation from the committee on tank cars, the effective date of the requirements of Section 7 (c) of the Specifications for Class I and II Tank Cars, and the last paragraph of Section 7 (d) of the Specifications for Class III and IV Tank Cars is further extended to February 1, 1924. The sections of the Tank Car Specifications referred to provide that no nipples, valves or other attachments shall project below the bottom outlet cap except while car is being unloaded.

France Adopts the Westinghouse Brake

The Superior Council of Railways of France has ratified the decision of a special commission appointed by the Ministry of Public Works adopting the Westinghouse air brake as the standard for French railways. The special commission tested three brakes, viz., the Westinghouse, the Lipkowski and the Clayton-Hardy vacuum. It is now proposed that the French Minister of Foreign Affairs should call a meeting of representatives of the allied countries in accordance with the Peace Treaty with the view of standardizing air brakes in continental Europe. The choice of the Westinghouse brake is said not to involve its exclusive use, but that any other similar pressure brake capable of being operated with the Westinghouse might be allowed.

Fuel Association to Determine Relative Values of Coal and Oils for Locomotives

The International Fuel Association is investigating the relative values of various locomotive coals and fuel oils available for locomotive use and will present the results in the form of a paper at its next annual meeting. The relative value of solid and liquid fuels is not represented by their comparative B.t.u. content principally because the standby losses with fuel oil are much lower than where coal is burned. The results of this investigation will be of particular value to the railways in determining the relative prices they can afford to pay for coal and oil. This will also establish the true relative fuel efficiency of railroads burning fuel oil in comparison with coal burning roads. The Interstate Commerce Commission now requires railways burning fuel oil to report the equivalent consumption of coal per freight ton mile and per passenger car mile on the assumption that 3½ barrels of fuel is equivalent to one ton of coal.

The association has further planned to make an extensive study of locomotive fuels being mined in various parts of the country and will present at its next annual meeting a symposium on methods best adapted to utilize such fuels as are now available. This will relate particularly to the availability of lignite, peat and other low grade fuels for locomotive use. The association also contemplates an investigation of the interrelation of the numerous fuel economy devices now available. The result of this investigation, which will also be presented at its next annual meeting, will show the savings that can be anticipated from a combination of several locomotive fuel economy devices such as the brick arch, superheater, feed water heater, syphon, etc. The facts to be developed in this report are of importance since the use of several of these devices in combination is becoming quite general.

The American Railway Association has recently expressed a desire to co-operate with the International Railway Fuel Association with a view to putting into general practice methods developed and recommended by the latter. Consequently, it will be the purpose of this association to devote considerable time henceforth to the solution of such detail problems relating to fuel use as are referred to it by the A. R. A. joint committee on fuel conservation. The immediate problem now under consideration is that of co-operative research, whereby the testing laboratory facilities of several universities can be utilized by the railways to determine the relative value of new locomotive devices and the comparative efficiency of various grades of coal in locomotive use.

MEETINGS AND CONVENTIONS

Southeastern Carmen's Association

The second session of the Southeastern Carmen's Association will be held at the Hotel Ansley, Atlanta, Ga., September 17 and 18. The following papers will be presented for discussion: Co-operation, W. W. Waits, Southern; Care and Maintenance Freight Air Brakes, A. G. Huston, Westinghouse Air Brake Company; Handling of Explosives and Inflammables, W. H. Evarts, Bureau of Explosives; Claims Prevention, F. Whittemore, New York, Chicago & St. Louis; A. R. A. Billing, B. F. Jameson, Southern.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION V.—MECHANICAL. V. R. Hawthorne, 431 South Dearborn St., Chicago.

DIVISION V.—EQUIPMENT PAINTING DIVISION.—V. R. Hawthorne, Chicago. Meeting September 4, 5 and 6, Hollenden Hotel, Cleveland, Ohio.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—W. C. Stephenson, Atlantic Coast Line.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, A. F. Stuebing, 23 West Forty-third St., New York.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio. Convention October 8-12, Ballroom William Penn Hotel, Pittsburgh, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual convention November 6-9, Hotel La Salle, Chicago. Exhibit by Railway Electrical Supply Manufacturers' Association.

CANADIAN RAILWAY CLUB.—W. A. Booth, 53 Rushbrook St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—Thomas B. Koeneke, 604 Federal Reserve Bank Building, St. Louis, Mo. Meetings, first Tuesday in month at the American Hotel Annex, St. Louis.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Meeting Hotel Statler, Buffalo, N. Y., Sept. 13. Motion pictures and dancing.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—W. P. Elliott, T. R. R. A. of St. Louis, East St. Louis, Ill. Annual meeting Hotel Sherman, Chicago, October 3, 4 and 5.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings second Tuesday, February, May, September and November.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. B. Hutchison, 6000 Michigan Ave., Chicago, Ill.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash St., Winona, Minn. Annual convention, Hotel Sherman, Chicago, September 4-7, 1923.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York, N. Y.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Meetings second Tuesday in each month, except June, July, August and September, Copley-Plaza Hotel, Boston, Mass.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meeting third Friday of each month except June, July and August at 29 West Thirty-ninth street, New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgreb, 623 Brisbane Building, Buffalo, N. Y.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Meetings second Thursday in each month in San Francisco and Oakland, Cal., alternately.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Meetings fourth Thursday in each month, except June, July and August, Fort Pitt Hotel, Pittsburgh.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Meetings second Friday each month, except June, July and August.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting, beginning September 11, 1923, Chicago. Exhibit by Railway Equipment Manufacturers' Association.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 605 North Michigan Ave., Chicago. Meetings third Monday in each month, except June, July and August.

SUPPLY TRADE NOTES

The Air Reduction Company, Inc., brought into production on July 15 its new plant at Sharon, Pa.

Charles E. Meyer, formerly secretary and treasurer of the Bagnell Timber Company, St. Louis, Mo., died on August 4 at his home in that city.

D. T. Harris, who has been associated with the sales department of the American Steel Foundries since 1904, died in Rochester, Minn., on July 25.

The Union Railway Equipment Company has discontinued its Montreal office and will handle Canadian business through its general office at Chicago.

P. J. Willis, formerly purchasing agent for the General American Car Company, Chicago, has become associated with the Coale-Fraser Lumber Company, Chicago.

The Flannery Bolt Company, Pittsburgh, Pa., has appointed the W. S. Murrian Company, with offices in the Cal Johnson building, Nashville, Tenn., as its southern representative.

H. L. Erlicher, formerly assistant to the general purchasing agent of the General Electric Company, Schenectady, N. Y., has been appointed assistant general purchasing agent.

John R. Hayward has been appointed southern representative of the Davis Brake Beam Company, Johnstown, Pa. Mr. Hayward's headquarters are in the First National Bank building, Roanoke, Va.

The Oilgear Company, Milwaukee, Wis., has appointed the E. A. Kinsey Company, 235 South Meridian street, Indianapolis, Ind., as the selling agent for Oilgear products in the states of Indiana, Kentucky and Tennessee.

J. Leonard Replogle, president and chairman of the executive committee of the Vanadium Corporation of America, New York, has resigned on account of ill health. Mr. Replogle remains as a director of the corporation.

Negotiations have been completed for the purchase of the Damascus Brake Beam Company, Cleveland, Ohio, by the American Steel Foundries, Chicago, the latter exchanging 1½ shares of preferred stock for each share of Damascus common stock.

A. N. Willsie has been appointed western sales manager of the Locomotive Stoker Company, with headquarters in Chicago, to fill the position recently vacated by A. C. Deverell, who has resigned to go into business for himself. Mr. Willsie started his railroad experience in the master mechanic's office on the Chicago, Burlington & Quincy in April, 1880. He worked in various capacities with the Burlington for 39 years, serving consecutively in the offices of the timekeeper, locomotive shops, car shops, and later became locomotive fireman and locomotive engineman and road foreman of engines. He was then division master mechanic, also division superintendent and for a number of years filled the position of supervisor of fuel economy at the general office in Chicago until he entered the service of the Locomotive Stoker Company as district engineer, which position he held up to the time of his appointment as western sales manager, as above noted.

A. N. Willsie

The American Brake Shoe & Foundry Company, New York, has purchased a four-acre site in North Kansas City, Mo., where it will manufacture brake shoes and iron castings. The construction of the building will be started at once and it is hoped to have it completed by fall.

E. F. Boyle, Monadnock building, San Francisco, Cal., has been appointed Pacific Coast representative for the Grip Nut Company, Chicago, and J. L. Stephenson, Munsey building, Washington, D. C., has been appointed a representative for the Grip Nut Company on certain railroads.

Harry J. Bell, secretary and manager of the Chicago Safety Council and formerly in charge of the safety program of the roads in the Northwestern region of the United States Railroad Administration, has resigned to become manager of the safety division of the Milwaukee Association of Commerce.

Henry J. Bailey, vice-president of the Consolidated Machine Tool Corporation of America, Rochester, N. Y., has been elected president, to succeed W. H. Marshall, deceased. Mr. Bailey began work with the Hilles & Jones Company, Wilmington, Del., in 1890, as a messenger boy, when he was 14 years old. He later served as shipping clerk and stenographer, in 1900 was appointed secretary of the company, subsequently assuming charge of sales, and upon the death of Alfred R. Jones in October, 1918, Mr. Bailey was elected president of the same company. During his service he worked in all the different departments of the business. On the formation of the Consolidated Machine Tool Corporation of America in June, 1922, of which the Hilles & Jones Company forms a part, Mr. Bailey became vice-president of the new corporation in charge of the Hilles & Jones works at Wilmington, and now becomes president of the corporation, with headquarters at Rochester, as above noted. The general offices of the corporation have been removed from New York City to Rochester, but its district selling organization will be continued at 17 East Forty-second street, New York City.

H. J. Bailey

The Pawling & Harnischfeger Company, Milwaukee, Wis., manufacturers of excavators, cranes and machine tools, has appointed the Laughlin Barney Machinery Company, Pittsburgh, Pa., to represent it in western Pennsylvania and eastern Ohio as sales agents for the company's horizontal boring, drilling and milling machines.

E. H. Hall, formerly superintendent of the car department of the Chicago-Great Western, with headquarters at Oelwein, Iowa, has been appointed special representative of the Robert M. Lucas Company, Chicago, manufacturers of flexible corrosion-proof cements for railroads for the territory west of the Mississippi river to the Pacific Coast. Mr. Hall's headquarters will be in Chicago.

F. H. Rood has been appointed engineer of tests of the Pittsburgh Testing Laboratory, with headquarters at Pittsburgh, Pa. Mr. Rood is a civil engineer graduate of Syracuse University. For many years he served as engineer of tests for the New York State Highway Commission and for three years was assistant engineer of tests, Pittsburgh Testing Laboratory; then for two years a research engineer with the U. S. Bureau of Public Roads.

The Surplus Steel Exchange, Inc., New York City, which was recently organized, has opened an office in Chicago at 2257 Oakdale avenue, in charge of A. E. Thiffault and Raymond I. Caspers, both of whom have been affiliated with the steel trade for many years. Mr. Thiffault was formerly with the American Sheet & Tin Plate Company, and Mr. Caspers was formerly with the Illinois Steel Company and the American Sheet & Tin Plate Company.

Waldo H. Marshall

While boys of his age were preparing for college Waldo H. Marshall was chief draftsman of the Rhode Island Locomotive Works. His ideas of engineering design particularly concerning locomotives and his ideals of managing men began to take form during his machinist apprenticeship at those works. Industrious study, deep thought, ability, a remarkable mind, clear and balanced, a lovable character, all combined in 35 years of constructive life, give the world a valuable and unusual legacy. Nearly all his work was either for or directly with railroads. With grade schools and night school as a foundation he became an engineer and an administrator. Because he was not a college man he was the more careful and thorough. Many a college educated engineer had to go back over his work and correct it because of the direct thinking, common sense methods of analysis of his superior.

W. H. Marshall

In his early work he profited by association with David L. Barnes. He succeeded Mr. Barnes at the Rhode Island Locomotive Works. Then he went to New York on engineering work for the New York elevated and cable railroads. Before the World's Fair he took the editorship of the Railway Review in Chicago and later became editor of the Railway Master Mechanic, also in Chicago. During this time he designed the details of the movable sidewalk at the World's Fair. He also designed and patented the Simplex truck bolster, which represented the beginning of his influence upon the design of railroad rolling stock in the direction of maximum strength per unit of weight. That unnecessary weight should exist in either cars or locomotives troubled him. He must be credited with beginning systematic improvements in this direction.

He continued editorial work with M. N. Forney on the American Engineer (now the *Railway Mechanical Engineer*) in New York, but with a strong desire for a railroad opportunity which came to him in 1897 in the position of assistant superintendent of motive power, Chicago & North Western. The Lake Shore & Michigan Southern made him superintendent of motive power in 1899 and here he began to give us the locomotive policy that not only this but every railroad needs. Track and bridges on that road were proverbially light. He began an epoch making series of locomotive designs, the best and most powerful the rails would take. He helped to get heavier track and bridges and followed with power developed in parallel with the means for carrying it. He was one of the pioneers in locomotive terminals and then in shop development. Results brought him into the operating department in 1902, first as general superintendent and then as general manager. During this time he found and advanced many a young man whom he trusted and who abundantly justified his judgment. In these men his ideas and ideals are going forward for the improvement of transportation. Many a young man must say that Waldo Marshall made him. The one who writes these words says it of himself. Waldo Marshall himself was trusted. He once told an intimate friend that in his railroad career he was only once turned down when he made a recommendation. That was when the road, without his knowledge, had already bought a small road that he thought should be acquired. The young railroad officer who "gets" this lesson from his life is fortunate.

At the time when railroads were beginning to realize the necessity for more powerful locomotives he was called in 1906 to the American Locomotive Company as its president. He not only helped materially to meet this need, but contributed a vital part in the direction of the change in locomotives from mere pullers of trains to efficient power plants.

In the World War he rendered service with J. P. Morgan & Company and with the Naval Consulting Board. At the close of the war he became chairman of the board of Gillespie & Company. At the time of his death he was chairman of the board and president of the Consolidated Machine Tool Corporation of America and director of several companies and financial institutions.

Through his life he sought to serve others. He served them well.

He was born June 7, 1864, in Providence, Rhode Island. He died at Barnstable, Massachusetts, August 23.

G. M. Basford.

H. W. Johnston and A. C. Steinmetz have been appointed service engineers of the Franklin Railway Supply Company, Inc., New York City. Mr. Johnston was formerly supervisor of machinery and tools of the Delaware, Lackawanna & Western and later in the service of the Baltimore & Ohio, reporting to the general superintendent of motive power, and Mr. Steinmetz was formerly an engineman on the Cleveland, Cincinnati, Chicago & St. Louis, who also served as a member of the Board of Locomotive Engineers.

The recently organized Midvale Company, successor to the historic Midvale Steel Company, reports that it is operating its various departments on a fair schedule in the production of forgings, tires, large and small rings, roll shells, large crank shafts, hardened and ground rolls, special designs of extrusion cylinders and liners, piston and hammer rods, and forged members to withstand shock and fatigue. It is also producing, as a special product, large quantities of iron and steel castings, rough and machined, for nearby industries. There is an active increase in its business of carbon and high speed tool steels, and its purpose is to expand its tool steel output in the near future to include all analyses and sizes.

In charge of the plant is Dr. H. L. Frevert, who started with Midvale about 15 years ago, after graduating from Harvard University. In addition to the other departments, the Midvale Company continues to conduct its research work under the supervision of Dr. Frevert and John Lyman Cox.

The Midvale plant, in addition to the steel works, forge and hammer shops and rolling mills, has eight large machine shops. These include one tire machine shop, a slicing shop, two roughing shops and four shops for general finished machined work. In addition to previously mentioned units, the Midvale Company has iron, steel and brass foundries. These foundries are utilized principally for the production of large castings to go along with forgings.

The following officers of the company have been elected: Alva C. Dinkey, president; Dr. Harry L. Frevert, vice-president; James M. Milliken, secretary and treasurer; Stuart Hazelwood, vice-president in charge of sales.

John N. Reynolds, formerly western manager of the Railway Age—an announcement of whose death in San Diego, Cal., on July 10 was published in the August issue of the *Railway Mechanical Engineer*—was for many years widely known among officers of railways and railway supply companies, especially the latter. He commenced newspaper work with the Boston Advertiser in 1872. In the same year he became associated with Edward Vernon and others in preparing and publishing, in 1873 and 1874, the "American Railroad Manual of the United States and the Dominion." From 1874 to 1881 he was connected with Poor's Manual of Railroads. From 1875 to 1883 he did his first work in the business department of the Railroad Gazette. From 1881 to 1894 he was connected with the National Car and Locomotive Builder; and in 1881 he published the first directory of street railways of the United States, Canada, Mexico and South America. From 1894 to 1901 Mr. Reynolds was western representative of the Railroad Gazette.


John N. Reynolds

In May, 1901, he became vice-president of the Railway Age, which position he held until May, 1908. On June 1, 1908, the Railroad Gazette, which was published in New York, and the Railway Age, which was published in Chicago, were consolidated, and Mr. Reynolds was appointed western manager of the consolidated paper. He continued to hold this position until January, 1913, when he retired, later moving from Chicago to San Diego, Cal., where he lived until the time of his death. Mr. Reynolds' active connection with railroad publications extended over a period of 40 years.

Mr. Reynolds was born in England, August 24, 1846. The accompanying photograph was taken some years ago. We are printing it because none of the later pictures was a true likeness.

H. H. Pleasance, general manager of sales of the United Alloy Steel Corporation, and H. C. Thomas, assistant general manager, with headquarters at Canton, Ohio, have been promoted to vice-presidents, with the same headquarters. Mr. Pleasance entered business with the Standard Oil Company of Cleveland, Ohio, in whose employ he remained until 1903, when he entered the service of the Cambria Steel Company at Cleveland. After a short time in the Cleveland office he was transferred to the Detroit district, which embraced lower Michigan and northern Indiana. In 1913, he resigned from the Cambria Steel Company to enter the employ of the United Steel Company as sales manager, with headquarters at Cleveland, Ohio. In January, 1917, he entered the employ of the United Alloy Steel Corporation as assistant general manager of sales, which position he held until May 1, 1917, when he was promoted to general manager of sales. He held the latter position until his recent promotion.

H. H. Pleasance

Mr. Thomas entered the employ of the Wheeling Steel & Iron Company as a chemist in 1900 and subsequently was connected in chemical, metallurgical and operating executive capacities with the Alan Wood Iron & Steel Company and with the United States Steel Corporation's plants at Braddock, Pa., Duquesne, Donora, Clairton and Gary, Ind. From 1908 to 1918 he was assistant general superintendent of the United States Steel Corporation's plant at Gary, Ind. On the latter date he resigned to enter the employ of the United Alloy Steel Corporation as general superintendent which position he held until September, 1922, when he was promoted to assistant general manager.

H. C. Thomas

The co-partnership of Robert W. Hunt & Co., Chicago, on July 2 was incorporated under the name of Robert W. Hunt Company and the officers are now as follows: John J. Cone, president, D. W. McNaugher, vice-president and treasurer, C. B. Nolte, vice-president and general manager, W. A. Gresens, secretary and assistant treasurer. The board of directors includes the above officers, also Luther V. Rice and J. C. Ogden. The official personnel of the corporations, 20 domestic and 8 foreign, or international offices, remains unchanged.

TRADE PUBLICATIONS

Rivet Forges.—A 4-page, illustrated bulletin, No. 504, describing a new suction feed type Venturi fuel oil-burning rivet forge, has recently been issued by the Hauck Manufacturing Company, Brooklyn, N. Y.

Portable Oil Heaters.—A 16-page illustrated bulletin, No. 503, describing the latest Venturi oil-burning torch for making locomotive steel car and rip track repairs, has recently been issued by the Hauck Manufacturing Company, Brooklyn, N. Y.

Zinc Roofing.—The New Jersey Zinc Company, New York, has issued a small leaflet outlining the adaptability of standing-seam Horse Head zinc roofing for many types of buildings. The leaflet is illustrated with sketches showing how the roofing is applied.

Alternating Current Motors.—The Reliance Electric & Engineering Company, Cleveland, Ohio, has just issued a 14-page illustrated bulletin, No. 5018, descriptive of its new line of Type AA induction motors for two and three phase alternating current circuits. These motors, which are of the squirrel cage type, range in sizes from ½ to 25 hp., and in speeds from 900 to 1,800 r. p. m.

Riveters.—The Hanna Engineering Works, Chicago, has recently issued a 64-page illustrated booklet, Catalogue No. 5, fully describing the design and construction of its compression yoke riveters, which range in sizes from 4 in. to 21 ft. reach, and in capacities from 10 to 150 tons. These riveters are particularly adapted for use in the boiler, tank, structural, bridge, car, and steel shipbuilding industries.

Stools, Chairs and Factory Equipment.—The Angle Steel Stool Company, Plainwell, Mich., is distributing a 40-page illustrated catalogue, showing many patterns of angle steel constructed stools and chairs, including specially designed folding chairs for car usage and steel and wood seated stools and chairs of both the stationary and revolving types for the shop and office. Bench legs, chip pans, tote boxes, staves and trucks for shop use are also listed.

Mixing Coal.—In a 12-page illustrated bulletin, the Roberts & Schaefer Company, Chicago, present a number of excellent photographs and a description of the South Junction coaling station of the Delaware & Hudson, which was designed to mix anthracite and bituminous coal in delivering this coal from the track hoppers to the storage bin. Illustrations and brief descriptions are also given of other coaling stations recently built by this company on various railroads.

A Test of Integral Waterproofing.—In an eight-page folder issued by the Truscon Laboratories, a report is presented of tests made by Samuel R. T. Very, architect, on the increased impermeability of concrete containing an integral waterproofing compound. The report is presented in an entertaining way with no similarity to the exceedingly prosaic style commonly used in reporting such tests. The conclusions obtained are also presented in a concise way so that the busy reader has no difficulty in getting at the fundamental facts. As pointed out in the report, the tests were conducted so as to approximate as nearly as possible the kind of workmanship commonly obtained in actual concreting rather than that secured under laboratory conditions.

Oil Storage Systems.—An attractively prepared bulletin containing 49 8-in. by 10-in. pages devoted to oil storage systems has been issued by S. F. Bowser & Co., Inc., Fort Wayne, Ind. This bulletin is intended primarily for reference by railroad men who have to deal with the pumps, tanks and devices used in storing or handling oils, gasoline and other liquids. Clear-cut illustrations in color accompanied by appropriate descriptive data are given in various parts of the equipment, including agitators, agitator tanks, barrel-filling equipment, carload storage tanks, gravity-filling devices, measuring systems, oil pumps, mixing tanks, self-measuring pumps, signal oil pumps and out-pits, and many others. Several interesting illustrations are included of oil supply cars which are now in satisfactory service, effecting important economies in handling and supplying oils to outlying points. The bulletin explains the advantages of Bowser equipment in economy, convenience, safety, dependability and long service.

EQUIPMENT AND SHOPS

Locomotive Orders

THE SAVANNAH & ATLANTA has placed an order for one 2-8-2 type locomotive with the Baldwin Locomotive Works.

THE TORONTO, HAMILTON & BUFFALO has ordered two 4-6-2 type locomotives from the American Locomotive Company.

SUL MINIERA REDE DE VIACAO, Brazil, has ordered two 2-8-0 and six 4-6-0 type locomotives from the Baldwin Locomotive Works.

THE CALIFORNIA WESTERN RAILROAD & NAVIGATION COMPANY has ordered one 4-6-0 type locomotive from the Baldwin Locomotive Works.

THE RICHMOND, FREDERICKSBURG & POTOMAC has ordered two 4-6-2 locomotives from the American Locomotive Company and two 4-6-2 type from the Baldwin Locomotive Works.

Locomotive Repairs

THE ST. LOUIS-SAN FRANCISCO is to convert the passenger locomotives on its lines between St. Louis, Mo., Oklahoma City, Okla., Memphis, Tenn., and Kansas City, including all locomotives on suburban runs and also switching engines, to oil burners, and intends to complete the job by October 1. With this change 14 passenger engines will be released for freight service, since the oil burners will make longer runs.

Passenger Car Orders

THE HAVANA CENTRAL has ordered 3 Mack gasoline rail motor cars from the International Motor Company for use on the United Railways of Havana.

THE MISSOURI PACIFIC has ordered 18 coaches, 12 chair cars and 10 baggage cars from the American Car & Foundry Company, and 9 divided coaches, 3 cafe club cars and 8 dining cars from the Pullman Company.

Passenger Car Repairs

THE LAKE ERIE & WESTERN is having steel center frames and axle lighting equipment installed on 15 coaches in its shops at Stoney Island, Chicago.

THE NEW YORK CENTRAL is making repairs to 10 coaches in the Collinwood, Ohio, shops. The improvements include putting steel underframes on these coaches.

Freight Car Orders

THE CANADIAN NATIONAL has ordered 1,000 automobile cars from the Pressed Steel Car Company.

THE WABASH has ordered 75 steel underframes for freight cars from the American Car & Foundry Company.

THE CHICAGO & NORTH WESTERN has placed an order with the General American Car Company for 1,000 stock cars.

THE NEW YORK, CHICAGO & ST. LOUIS has ordered 100 steel underframes for box cars from the Pressed Steel Car Company.

THE GENERAL SUGAR COMPANY, New York City, has ordered 100 cane cars of 30 tons' capacity from the Gregg Company, Ltd.

THE MEXICAN PETROLEUM COMPANY has ordered 25 tank cars of 8,000 gal. capacity from the General American Tank Car Corporation.

THE STANDARD OIL COMPANY OF NEW JERSEY has ordered 12 50-ton steel dump cars from the American Car & Foundry Company.

THE CHICAGO & NORTH WESTERN has ordered 50 center constructions for freight cars from the Western Steel Car & Foundry Company.

THE SHELL COMPANY of California (San Francisco), has ordered 60 tank cars of 10,100 gal. capacity with 50-ton trucks from the Pennsylvania Tank Car Company.

THE PERE MARQUETTE has ordered 300 underframes from the Pressed Steel Car Company. These are to be used for refrigerator cars to be built in the railroad company's shop.

Freight Car Repairs

THE ATLANTA & WEST POINT will rebuild 75 box cars in its shops at Montgomery, Ala.

THE PERE MARQUETTE ordered 25 steel center constructions for caboose cars, from the Pressed Steel Car Company.

THE CARNEGIE STEEL COMPANY has ordered repairs to 22 gondola cars from the Tonawago Car Company, Warren, Ohio.

THE PHILADELPHIA & READING has arranged for the repair of 500 steel hopper cars with the Standard Steel Car Company, at Middletown, Pa., and for the repair of 200 steel hopper cars with the Pressed Steel Car Company.

THE NEW YORK CENTRAL has given a contract to the Standard Tank Car Company for the repair of 500 all-steel hopper cars of 55 tons' capacity for the Pittsburgh & Lake Erie, instead of for converting 500 old box cars to stock cars as was reported in the August *Railway Mechanical Engineer*. The conversion of the 500 box cars to stock cars will be carried out by the Standard Steel Car Company.

Machinery and Tools

THE NEW YORK CENTRAL has placed an order for a 42-in. lathe.

THE TEXAS & PACIFIC has ordered a five-ton hand power crane from the Whiting Corporation.

THE CHICAGO, BURLINGTON & QUINCY has ordered one 20-ton locomotive crane from the Browning Company.

THE SOUTHERN PACIFIC has placed orders for a 200-ton locomotive lifting crane and a 215-ton crane for its Los Angeles shops.

THE PERE MARQUETTE has placed orders for a number of tools including 3 axle lathes; a plate flanging clamp; 3 steam hammers of 1,500-lb., 2,500-lb., and 6,000-lb. capacity, respectively; a locomotive axle journal turning lathe; a 100-in. tire boring and turning mill; a 36-in. planer; a 36-in. slab miller; a 66-in. vertical miller; 3, 5-ft. radial drills; a two-spindle rod borer and some miscellaneous types of tools, including milling machines and lathes.

Shops and Terminals

DETROIT TERMINAL.—This company has awarded a contract to the Roberts & Schaefer Company, Chicago, for the installation of an electric cinder handling plant at Detroit, Mich.

KANSAS CITY SOUTHERN.—This company will rebuild its car repair shop at Shreveport, La., which was damaged by fire on July 11, with a loss estimated at $125,000, including equipment.

PERE MARQUETTE.—This company has awarded a contract to the Arnold Company, Chicago, for the construction of a 16-stall brick roundhouse and the installation of a 100-ft. turntable at Erie, Mich.

MISSOURI PACIFIC.—This company has awarded a contract to the Folwell-Ahlskog Construction Company, Chicago, for the erection of a one-story, concrete boiler house adjacent to the new grain elevator at St. Louis.

CHICAGO & NORTH WESTERN.—This company has awarded a contract to the Howlett Construction Company, Moline, Ill., for the erection of a 200-ton frame coaling station, with automatic electrical equipment, at Waseca, Minn.

UNION PACIFIC.—This company has awarded a contract to the Graver Corporation, East Chicago, Ind., for a 25,000 gallon per hour capacity water treating plant at Armstrong, Kansas, and a plant of the same capacity at Marysville, Kans.

NEW YORK, CHICAGO & ST. LOUIS.—This company has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a 700-ton reinforced concrete coaling station with automatic elevating equipment, at Conneaut, Ohio.

Lake Erie & Western.—This company has authorized the construction of improvements and additions to its shops at Lima, Ohio, at a cost of approximately $150,000. When the new facilities are completed, the Lima shops will constitute the largest repair shops on the consolidated Nickel Plate system.

Illinois Central.—This company has awarded a contract to the Graver Corporation, East Chicago, Ind., for the installation of water treating plants at Webster City, Iowa Falls, Parkersburg and Dixon, Ill. The company has also authorized the construction of a new 18-stall roundhouse and coaling station at Council Bluffs, Iowa, and has awarded a contract to the Howlett Construction Company, Moline, Ill., for the construction of a 500-ton reinforced coaling station at Central City, Ky.

Chicago, Rock Island & Pacific.—This company has authorized the construction of the following new facilities and betterments: Water treating plants at Cedar Rapids, Iowa; Albert Lea, Minn.; Faribault and Owatonna, Minn.; Fairbury, Neb.; Scandia, Kan., and Willard; a 400-ton coaling station and cinder pit at Rock Island, Ill., a 200-ton coaling station and cinder pit at Council Bluffs, Iowa, a 400-ton coaling station at Eldon, Iowa, and a 300-ton coaling station at Dalhart, Tex.; extension of four roundhouse stalls, replacing of a cinder pit and building a drop pit at Haileyville, Okla.; the construction of four new stalls and the extension of 13 stalls in the roundhouse at Shawnee, Okla.

PERSONAL MENTION

General

Leo Burke has been appointed master car builder of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn.

Eugene S. Marsh has been appointed general storekeeper of the Wheeling & Lake Erie, with headquarters at Brewster, Ohio, succeeding William Hunt, resigned.

O. T. Rees, assistant chief chemist of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., has been promoted to chief chemist, succeeding W. A. Powers, resigned.

H. W. Johnson has been appointed superintendent of motive power and rolling stock of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., succeeding William Gemlo, resigned. Lee Chapman has been appointed assistant superintendent of motive power and rolling stock, with the same headquarters.

J. E. O'Brien, manager of the mechanical department of the Seaboard Air Line, will hereafter be chief of motive power and equipment. Mr. O'Brien will, as heretofore, report to the vice-president and general manager; also to the president.

G. N. DeGuire has been appointed manager of the Department of Equipment, United States Railroad Administration, succeeding Frank McManamy, who has been appointed Interstate Commerce Commissioner. Mr. DeGuire was born at Appleton, Wis., on March 31, 1880. At the age of 17 he entered the shops of the Valley Iron Works, Appleton, Wis., as a machinist apprentice. After serving four years in that capacity, he entered the service of the Chicago & North Western at Kaukauna, Wis., as a locomotive fireman, and was promoted to locomotive engineman in 1905. Seven years later he was granted a leave of absence covering a large portion of each year and which extended over a period of four years, so as to permit him to visit the principal railroad terminals in the central and eastern parts of the United States for the purpose of making a study of shop and enginehouse operation and the construction and maintenance of locomotives and cars. Following this Mr. DeGuire arranged for and supervised a special course at the Chicago shops of the Chicago & North Western covering construction and maintenance of locomotive boilers. In 1916 he was appointed inspector in the Bureau of Locomotive Inspection in the Philadelphia district. On January 1, 1918, when the railroads were placed under federal control Mr. DeGuire was appointed general supervisor of equipment, division of operation, in charge of shop and enginehouse operation on lines east of Chicago, and was later promoted to assistant manager, department of equipment, which position he was holding at the time of his recent promotion.

Master Mechanics and Road Foremen

F. E. Hillman has been appointed assistant road foreman of engines of the Northern division of the Chicago Great Western, with headquarters at Rochester, Minn.

S. H. Bray has been appointed road foreman of engines of the San Joaquin division of the Southern Pacific, with headquarters at Bakersfield, Cal., succeeding C. W. Jones, who has been assigned to other duties.

C. B. Rogers has been appointed master mechanic of the Minneapolis & St. Louis, with headquarters at Marshalltown, Iowa, succeeding L. D. Brown, resigned. The position of master mechanic at Minneapolis has been abolished and Mr. Rogers' jurisdiction will extend over the entire system.

P. Campbell, assistant superintendent of motive power of the Chicago Junction, with headquarters at Chicago, has been appointed to the newly created position of master mechanic, with the same headquarters, and the office of assistant superintendent of motive power has been abolished.

Purchasing and Stores

G. A. J. Carr, division storekeeper of the Chicago, Milwaukee & St. Paul, with headquarters at Minneapolis, Minn., has been promoted to assistant district storekeeper, with the same headquarters, and will be succeeded by H. E. Rice, division storekeeper, with headquarters at Austin, Minn., who in turn will be succeeded by W. M. Glenny.

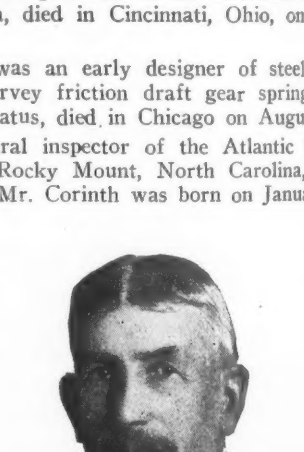
Obituary

M. S. Montgomery, fuel supervisor of the Northern Pacific, with headquarters at St. Paul, Minn., died in that city on August 8.

George A. Nolpe, grand vice-president of the Brotherhood of Railway Carmen of America, died in Cincinnati, Ohio, on August 11.

George L. Harvey, who was an early designer of steel cars and the inventor of the Harvey friction draft gear spring and also of a photographic apparatus, died in Chicago on August 13.

Albert B. Corinth, general inspector of the Atlantic Coast Line, with headquarters at Rocky Mount, North Carolina, died at his home on August 21. Mr. Corinth was born on January 2, 1854, at Philadelphia, Pa. He was educated at Girard College at Philadelphia, Pa., graduating with the class of 1870. He entered railway service on July 22, 1872, as apprentice on the P. & E. division of the Pennsylvania at Renovo, Pa. Since July 22, 1876, he had been consecutively six years in charge of cabinet shops of the Louisville & Nashville at Louisville, Ky.; one year in charge of freight car building with the Ohio Falls Car Company, Jeffersonville, Ind.; five years master car builder, Georgia division, East Tennessee, Virginia, and Georgia, at Atlanta, Ga.; three years in charge of freight equipment, Chicago & North Western at Chicago; three years in charge of the car department, Georgia Pacific division, Richmond & Danville at Birmingham, Ala.; six years foreman, car repairs, Southern Railway, Knoxville, Tenn. From January 30, 1900, to February 1, 1908, he was assistant superintendent Motive Power, Atlantic Coast Line, in charge of car department at Wilmington, N. C.; from February 1, 1908, to the day of his death he was general inspector of the same road at Rocky Mount, N. C.



A. B. Corinth